# Science Education

*Formerly* GENERAL SCIENCE QUARTERLY

**The Official Journal of the National Association for Research in Science Teaching, the National Council of Supervisors of Elementary Science, and the Science Association of the Middle States**

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Volume 19 APRIL, 1935 Number 2

## » » Contents « «

Vitalizing High-School Science Through the Learning Process. *Jessie Williams Clemensen* 49

Science for Children ..... *Helen L. Hultz* 56

Status of College and University Offerings in the Teaching of Science. *Henry Brechbill* 60

The Selection of Science Principles Suitable as Goals of Instruction in the Elementary School ..... *Martin L. Robertson* 65

An Experiment to Illustrate Mendel's Law ..... *H. F. Kilander* 70

The Effect of Teaching Stress Upon an Attitude ..... *Arthur Litchenstein* 73

Rejoinder to Article by E. E. Bayles on "Limitations of the Morrison Unit." *W. A. Robinson* 75

Elementary School Science Reference and Instruction Materials. *G. V. Bruce* 76

Abstracts ..... 79

New Publications ..... 85

News and Announcements ..... 90

PUBLISHED BY

SCIENCE EDUCATION, INCORPORATED

The subscription price is $2.00 a year; $2.50 in Canada and other foreign countries. Single copies are 60 cents; 75 cents in foreign countries.

Prices on back numbers will be sent on request.

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# Science Education

**Devoted to the Teaching of Science in Elementary Schools, Junior and Senior High Schools, Colleges and Teacher Training Institutions**

Volume 19 APRIL, 1935 Number 2


## VITALIZING HIGH-SCHOOL SCIENCE THROUGH THE LEARNING PROCESS


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"But there just isn't time!" This expression might be termed the one of greatest frequency among modern science teachers who are bewildered in the midst of all our new objectives for social living plus the multitude of subject-matter topics which it is still thought necessary to teach. Yes, we have been giving the world *facts* without teaching it how to think about those facts and how to use them properly. We feel the stinging truth of this indictment now so loudly voiced against scientists and science teachers. We are even criticizing ourselves severely, admitting that we have allowed our science to become divorced from life, that we have not made science function vitally in the lives of boys and girls, that we have not taught our pupils how to think scientifically, how to solve life-problems, how to recognize cause and effect relationships and how to think clearly concerning them, how to study effectively, and so on and on with the long list of shortcomings that blight our teaching. But there is hope in the fact that we all wish to overcome them. But how? Especially when our classes are so large and our minutes of class time are so few—how? It is with this problem that this paper deals.

Aside from curriculum revisions, which we shall omit here, there is much that each teacher can do with just the materials and time at hand. This accomplishment depends upon so applying the laws of learning that the crowded-out objectives concerning social living and right thinking may be attained as concomitants of the one learning process. That it is actually possible to do this has been proven indeed, by means of at least one teaching device, and there are certainly many other methods which are or could be used for this purpose. It is hoped that through the following discussion some of these other methods will occur to the reader. But since the

outcomes of using the particular instrument known as the "study outline" have been scientifically proven, however, we may here use this teaching procedure as a practical application of the psychological principles under consideration. These *Study Outlines in Physics* were used in an extensive and intensive experimental study, involving 850 high-school pupils.[1] In this experiment these *Outlines* were proven to be decidedly effective in producing in the one process factual learning, broad conceptual learning, effective study habits, interest in the course and in everyday science phenomena, problem-seeking and problem-solving attitudes, and other desirable concomitants.

We repeat that these outlines are merely one method of applying the laws of learning and the reader must not think that these particular study outlines carry a magic spell. They are simply a newly devised type of assignment embodying two inherent features which doubtless are responsible for most of their success. These two features are: (1) challenging, direct questions stated in terms of life situations; and (2) arrangement of these questions in outline form under "units" and "problems." Their simplicity in wording, construction, and use probably also contributes to their effectiveness. By this scheme the pupil is furnished with both a beckoning goal for each day's lesson and a complete "map" of the entire unit and course, with the result that at any time he may locate himself in his knowledge-quest, can summarize the ground covered, can see the larger things toward which he is striving, and can quickly relate today's lesson to yesterday's and tomorrow's.

Using these *Study Outlines in Physics* as our illustrative material, we now turn to review some of the principles of learning,[2] one by one, and endeavor to see how we may consciously and definitely apply several of these principles simultaneously in order to produce greater efficiency in learning.

*Psychological Law of Interest.* Learning is more efficiently accomplished when interest becomes inherent in the material to be learned.

Psychologists tell us that all education is based upon the instinct of curiosity. Nevertheless, the above quoted law of learning concerning the stimulation of interest and curiosity seems to be most neglected, abused, or misunderstood by educators. Many teachers appear to ignore it, while many others forget the "inherent" phrase of it and try to make their courses interesting by superficial "sugar coating." Yet within this principle lies the teacher's greatest opportunity for making science (or any subject) function vitally in the lives of his pupils. Incidentally, here is his greatest opportunity for assuring his own teaching success, for when genuine interest is aroused most discipline problems disappear and classroom procedures unfold themselves.

Hence, if the above statements are true, (to most teachers they seem self-evident), and if Thorndike is correct in saying that interest increases efficiency of learning, it appears then that time spent in stimulating interest in the topics to be studied is time profitably spent and that teachers could well afford to use the first few days or even weeks of the course, and much more time throughout the semester, in developing overviews that arouse curiosity and enthusiasm and give the proper mind-set for the work ahead. Care must be taken, however, to do this only with great sincerity and perfect honesty. The deception of a false picture followed by work which does not possess the intrinsic interest anticipated is one which pupils are quick to sense, and when this deception is once practiced no amount of effort on the part of the teacher can quite recapture the pupils' faith and enthusiasm.

It is in the presentation of an interest-arousing and honest overview that a properly written study outline performs its

first service. The outline is a promise "in black and white" of what the pupil may expect and demand from the course, and because of its brevity it gives him a more easily comprehended snapshot of the course than he would get from glancing through the text, though this latter method is usually good in stimulating curiosity, providing the text is interestingly composed and attractively illustrated.

No matter what form of overview or assignment is used, however, it should consciously aim to set into full swing the *Principle of Interest.* The raising of questions and problems (without answering them at the time) has been found to be most effective for this purpose. For instance, compare the following three ways of assigning the same topic:

*a.* Study pages 108–110.
*b.* Trace the circuit through a door bell and be able to explain its action. The reference is on pages 108–110.
*c.* Exactly what do you suppose happens when I push this button that should cause the bell to ring? What really does the work of ringing the bell? How? (I wonder!) What does the button have to do with it? What makes the noise? How? You may try to find out all this from the bell itself and with the help of your text, also, on pages 108–110.

Although *b* carries with it infinitely more intrinsic interest than *a,* nevertheless it is a command to perform a task and its psychological effect is not nearly so stimulating as the direct challenge of questions such as those of *c.* This last form, although it takes a little more time at the moment, is the most economical in the end because it tends to arouse curiosity and then depends upon this curiosity to furnish the driving force for finding the answers, and according to the *Principle of Interest,* when this inherent interest in the topic itself is the motive power, the "learning is more efficiently accomplished." This better learning was proven statistically to be true beyond doubt in the study cited earlier in this article. Hence we feel safe in saying that the direct question form of overviews and daily assignments is to be recommended.

It is impossible to emphasize too greatly the fact that the most important aspect of this principle of interest is embraced in the word "inherent." Interest must be "inherent in the material to be learned." The choice of material embodying this inherent interest is a curriculum problem and must be dealt with in another article. But even though a teacher may not, at present, have complete freedom as to choice of topics, still he is free to use his own ingenuity in presenting and illustrating those topics and if he is to make science real to his pupils he must find real illustrations from their own daily lives. Let him remember that for each individual, that individual himself is the center around which his own universe revolves. One simple way of finding illustrations that will vitalize school work is by a method which should be easy but seems difficult to many teachers, that is, to talk less and listen more — to encourage pupils to ask questions freely and to allow them plenty of rein in discussions. The teacher who is looking for indications of vital interest in the pupils will quickly detect them and will not find it difficult to guide, direct, and utilize what the pupils have initiated or that which they have taken enough part in to feel is theirs.

The *Study Outlines in Physics* we are using for illustration, were written according to the preceding principles, making use of direct questions possessing intrinsic value and interest for the pupils for whom they were written. The most conservative teacher would realize that these outlines cover all the standard material of high-school physics (and more) and that the general organization does not differ greatly from that of standard texts. Nevertheless, the learning of these fundamental principles by means of questions on life-situations

puts many of them in a new light and gives a new *reason* for learning them. Psychologically it is perhaps erroneous to say that this method stimulates interest, for in reality the interest was found to be there first and then the outline was devised to make use of this interest. The statistical results concerning interest manifested by pupils using these outlines were beyond expectations. After one semester of experimentation, (though no classes were aware of being experimented upon), all classes were given a twenty-four-item check-questionnaire, one item of which was:

> Do every-day things have more interest and meaning for you since studying physics?
> A great deal ——, Some ——, A little ——, None ——

The following shows the percentage of various groups giving the most desirable response to this question:

| *Column No.* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* |
|---|---|---|---|---|---|---|---|---|---|
| *Teacher* | *J* | *K* | *F** | *G** | *H** | *I** | *Total Outside Control* | *Total Non-Outline* | *Total Outline** |
| Per cent responding "a great deal" | 47 | 50 | 80 | 89 | 94 | 73 | 60 | 76 | 85 |

* Classes using the Outlines.

Column 8 represents classes paired pupil-by-pupil with the Outline classes (column 9) and having the same teacher and methods except for the use of the outlines; column 7 represents the control group which was paired with the Outline and Non-Outline groups, but whose teachers knew nothing of the Outlines; while columns 1-6 are for individual classes. Columns 1 and 2 are noteworthy and astonishing, since these teachers, J and K, are interested primarily in the movement to "popularize science" and they endeavor to popularize it by spectacular demonstrations, stereopticon slides, motion pictures, and field trips. Why this interest-response by their pupils should be so low is difficult to understand, but apparently the study outline questions appealed more to the pupils using them and suggested more "every-day" interests to them than did the more extraneous methods. This conclusion is substantiated, also, by much experimental data from essay tests and other questionnaire items which are too lengthy to be quoted here.

Just how this *Principle of Interest* operated in this case is clarified by Powers when he says, "Interest is inherent in instruction which develops ability to respond to a situation to which response has previously been thwarted by ignorance. . . . The question of interest in instructional material is resolved therefore into one which asks whether the instructional material has been selected so as to supply learning which allows response to situation (stimuli) that come within the learner's experience."[3] From this and the previous discussion we may conclude that a good direct question challeges a response, and that if the problem is based on a situation within the learner's experience his aroused desire to respond to it will constitute a stimulated interest. Furthermore, if the learning develops *ability* to respond, a course made up of a series of these challenges and satisfying responses will hold the *continued* interest of the pupils.

The reader is doubtless already aware of the operation of other principles of learning in conjunction with this *Principle of Interest*. That is necessarily true, for we cannot separate psychological principles in their action in human beings, and hence it is difficult to do so even for purposes of discussion. For instance, what has just been said above concerning challenged interests and satisfying responses brings to mind another law, namely, the

*Principle of Satisfaction.* Becoming conscious of unanswered questions brings a state of dissatisfaction which is removed by finding the answers to the questions. This satisfaction strengthens the bonds formed.

To this we might add that if this "state of dissatisfaction" is to be deep enough and last long enough to insure the finding of the answers, with high-school pupils at least, the "unanswered questions" must seem vital to the pupil and must come within his experience. In such a case interest and satisfaction work together and we may be doubly sure of the results.

The fact that finding the answers to such questions "strengthens the bonds" would account, to a great extent, for the test outcomes of the study outline experiment. All the statistical results of that study are consistent and give conclusive proof that in both standardized objective tests and essay tests a real difference existed in favor of all Outline groups over their paired non-Outline groups and control groups. These test data, of course, cannot be attributed entirely to the strengthening of the bonds due to satisfaction, however, for ability to respond to a test also depends upon the

*Principle of Identification.* Situations and responses to be connected should be identifiable in the mind of the learner.

Since the purpose of these particular study outline questions was to enable the pupil to learn the principles of physics by means of problem situations, it is natural that he should have recognized the need for applying these principles when he met their related problems in a test. Through daily experiences the experimental pupils had formed the habit of meeting and responding to problems, and to such pupils, who have the problem-solving attitude and technique, tests are not such novel experiences. This might explain the common experience of poor test results obtained by some hard-working teachers who solve all problems for their pupils and who spend all their time and energy in telling them the facts of the periodic table, Ohm's law, photosynthesis, and even of digestion, without leaving a moment to make sure that these ideas become more than abstract book-facts to the pupils, or to point out how these facts may be used for the betterment of daily living, or to give the pupils opportunity to solve any problems for themselves.

Of course, all situations in which we hope the pupil will be able to identify and apply a given principle cannot be pointed out in classwork, but for suggestions as to how to make our efforts carry over into daily life as much as possible, we turn to two other psychological principles:

*Principles of Analogy.* Responses should be attached to the situations in which they are to be used; the greatest amount of *transfer* is to be expected when situations have as many elements in common as possible, and when these elements are brought into consciousness.

*Principle of Analogy for Generalizations.* A generalization is best formed when several situations containing a common element and other situations containing a contrasting element are presented. The formation of the generalization is facilitated when the learner becomes conscious of the common elements and the contrasting elements.

From these two principles it appears that a grouping together of questions presenting different though closely related situations would be superior to the presentation of a mere list of questions without any organization. When several questions under one problem appear as corresponding parts in an outline, the pupil is guided in searching for common elements and making a larger generalization. That a study outline can actually accomplish this was proven by the fact that the five essay tests showed that the pupils who used the *Study Outlines in Physics* held in mind a greater number of clear statements of scientific principles than did the other

pupils, while the objectives tests showed that the outline pupils were also better able to apply the principles. For instance, in the final essay test pupils were simply asked to "write a summary of the outstanding principles, facts, and ideas of the semester's work in physics." An analysis of a random sample of 30 papers from each group, Outline, non-Outline, and control, showed that these groups made, respectively, 307, 235 and 148 statements of principles or generalizations. Just why the groups varied so in their expression of these larger ideas in a free-association test must have been due to the operation of these two laws through the outline form in which the work was studied by the one group. Since the non-Outline group was taught by the same teachers that taught the Outline group the results indicate that there had been some carry over of the vital organization of the subject matter through the teacher.

Some other interesting facts disclosed by these same essay tests bring other psychological principles to our attention. The thirty essays for each group, mentioned above, contained a total of 1041 statements made by the Outline group, 789 by the non-Outline group, and only 489 by the control group. Also, the papers for the Outline group were, in general, a great deal better organized than were the others. These data indicate, for one thing, that the Outline pupils must have actually made more learning connections according to the

> *Principle of Use.* We learn the connections we actually make. The connections may appear in the form of attitudes and mental habits as well as in the form of knowledge and physical habits.

But according to Thorndike's many experiments this principle operating alone could not account for such outstanding results, for he revised this statement in the following two ways:

> *Revised Principle of Use and Recency.* Repetition of a connection in the sense of mere sequence of the two things in time has very, very little power, perhaps none at all, as a cause of learning (without association and satisfaction).
>
> *Law of Association.* We learn associations that reasonably belong together and not those that just occur together.

The latter principle Thorndike himself seems to consider of prime importance. When we study the three principles together the logical explanation of the data given above, with their implications of vital results for the Outline pupils, seems to be that these pupils had not only made more connections, *i.e.,* learned more ideas, but that through the use of the outlines they had learned together ideas which reasonably belong together in everyday life and that because of this "belongingness" the associations were more firmly fixed in their minds and hence were more readily recalled.

Surely, if teachers realized the great value and increased efficiency in applying this one *Principle of Association,* they would gladly give more time and attention to organizing school work and helping their pupils to organize it. We as teachers cannot trust that "luck" will somehow put together in the minds of our pupils these ideas that reasonably belong together. We must put them together in their vital relationships, and a logical outline is one good way of doing it.

One other feature of the *Principle of Use,* above, must be mentioned. Notice that the connections we actually make "may appear as attitudes and mental habits." Thus, just as a child learns to walk by practice in using his muscles in a certain way, so he learns to use his mind efficiently and logically by practice in using it in that way. If we want him to develop certain study habits we cannot simply tell him how to study but must give him opportunity to study that way; if we want him to ac-

quire the habit of seeing things in their proper settings and of looking for cause and effect relationships in everyday life we must give him day-by-day experiences in seeing and working out such relationships; if we want him to have the problem-solving attitude outside the classroom we cannot expect him to attain it by merely listening to a lecture explaining and extolling it, but must give him daily exercise in seeing and solving vitally interesting problems. To accomplish these results it is not necessary to break up the class period and study period with a few minutes devoted to the development of each of these desired habits. Such a procedure would be futile as well as inefficient, for all these habits and attitudes may and should be achieved as concomitants of the one learning process. Here again our study outline furnishes us an example, for a little thought reveals how the constant use of a question-problem type of outline-assignment gives the pupil daily practice in studying in an orderly and efficient manner, in thinking in terms of cause and effect relationships because of his continual search for the answers to "What causes,?" "Why,?" *etcetera,* and how this process gradually develops these good habits in him.

In this discussion we have left until the last the psychological principle which pupils themselves appear (from questionnaire results and conversations) to feel is most vital to them in learning, though of course they would not recognize this law in its technical terms. This is the

> *Principle of Mind-Set.* Keeping a problem in mind will focus attention on the elements in the situation which appear to be relevant to the solution of the problem.

It is an interesting fact that on an impersonal questionnaire asking several questions with no answers suggested, every pupil who said he had conscientiously used the *Study Outlines in Physics* also answered "Yes" to the question, "Do you feel that the Outlines were of any help to you?" Most of their spontaneous answers to the next question, "If so, how,?" depend upon the application of this *Principle of Mind-Set,* that is, of having something specific toward which to work. The largest percentage of responses were that they "Helped me to get the main points (56%), while others were: "Good summary for review," (every teacher and pupil knows that an aimless, hopeless thing a review can be), "Easier to study, made things more clear," "Saved time," "Gave better general idea of work; broader idea of subject," and other similar reasons. And what these pupils thought to be true in their own opinions they unknowingly proved to be facts by their test grades as well as by their daily class discussions. Even high-school seniors recognize the greater efficiency with which they study when given a specific and vitally challenging assignment, and most pupils truly appreciate the extra time the teacher takes in preparing such assignments.

In the short space of this paper it has been possible to touch only briefly upon some of the most important phases of the psychology of learning as they may be applied in order to vitalize the learning of science. Although these principles have been discussed separately, we have endeavored to point out how, by conscious effort, many of these principles may be made operative simultaneously, thus stimulating vital interest and producing economies in teaching and learning. The author is aware of and uses many different procedures when desiring to apply one or more of these principles with special emphasis, but has yet found no method that accomplishes quite so many different objectives at one time as does the problem-outline type of assignment here mentioned to illustrate the psychological principles under discussion. When we have learned to apply these principles we will no longer feel that "we do not have time" to vitalize our science, for

we will be teaching it in a vital way every moment of our class time. When this goal is reached we can rest assured that our science is functioning and will continue to function in the every-day lives of our pupils.

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# SCIENCE FOR CHILDREN

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When the elementary school accepted child experience as the center about which learnings should be grouped science had to become one of the definitely included fields. For science is a matter of experience rather than textbook interpretations, and these experiences are not confined to any grade level. The opportunity of the present-day teacher is to make these experiences more meaningful.

Accepting the idea that science is a part of child experience, it is interesting to analyze some of the present teaching practices to see how this principle is carried out. Over 500 general units were submitted by teachers in New York State for analysis by the Informal Teaching Committee of the Principals' Association during 1932 and 1933, in preparation for the fourth New York State Bulletin on elementary education.[1] The units show many interesting and significant trends in science teaching. Excerpts from these units and from other sources describing classroom practice illustrate how science is making child experience more meaningful.

These samples show how science is used in interpreting children's experiences. Many things which children do will end with the experience unless their attention is directed to meanings and implications that are involved. For example, children can sail boats without understanding floating bodies or learning about water displacement, but if they enjoy this experience with someone who is aware of the scientific meanings involved the experience becomes more educative for them. Many children can watch a bowl of fish, a turtle, an ant colony, a mill wheel turning, or a moving train time after time without making the observation contribute significantly to learning.

*Studying floating bodies**

The children held a sort of regatta. In sailing their boats they found out many things about floating bodies. The children realized that it is necessary to have the cabin near the center of the boat's deck. They found out some facts about water displacement and the amount of ballast required to sink their boats to the most effective depth.

*Studying fish**

The children observed goldfish to note the purpose of the fins and tail in locomotion; to

* All asterisked activities throughout this article are taken from Bulletin No. 4; others are taken from classroom situations not reported in the Bulletin.

watch how a fish breathes under water; and to study their coloration.

*Watching a turtle**

A second-grade child brought his turtle to school. The children placed him in an aquarium and observed how turtles breathe. They watched him come up to the surface for air, and realized the necessity for supplying him with an island or stone to gain access to the air.

*Learning how an engine runs**

Another group of children playing with trains asked, "What makes the train go? What is the cow catcher for? How is the train guided? What are the two round things on top? Who operates the signals?"

While discussing these things one child brought a toy ferris wheel run by steam. The children observed the valves open and shut to admit and retain steam. This explained the action of the piston rod on the train engine. Another child brought a *Book of Knowledge* showing a cross sectional view of the engine.

Once children have experienced the fun of investigating, of finding out for themselves, or of observing carefully enough that many questions or problems are suggested to them by their observation they have added experimentation as an aid to their observation. In the samples that follow one group of children experimented to answer their question, "How do seeds grow?" Another group tried out different experiments to discover why moisture particles would collect inside a covered jar, while a third group made an indoor pool where they could watch water insects more carefully.

*Finding out how seeds grow**

Cotton gauze was placed over a tumbler of water and a few beans put on top of the cloth. The children watched these unfold, grow little roots into the water and open to form leaves above. From this they drew generalizations with reference to plant growth in their outdoor garden.

*Making a rain jar*

Some children of the fifth grade put earth in a glass bowl and planted moss, grass, and small plants in it. They covered the jar with a piece of glass. They observed that sometimes it rained inside the jar and sometimes not. They noted the room temperature, then placed the jar outside, also a thermometer. As the temperature dropped moisture collected inside the jar. When the jar was brought inside the room the moisture disappeared. This was quite a mystery. They worked a long time to solve it.

*Making an indoor pool*

A group of children who had caught water-striders, back swimmers, water beetles, dragon fly nymphs, and blood suckers made an indoor pool out of a sandtable so they could study them during the winter.

Many investigations which children make and experiences in which they engage may suggest questions and things to do requiring further science study and research or reference work. The following samples illustrate how children's investigations advanced their science study and developed wider and deeper interests.

*Studying plants in different areas*

The class divided into several groups to find out what kinds of plants were growing in the school yard. They chose different spots to study such as the top of the hill, the hill-side, the meadow, and a clump of trees. Each group marked out a square yard and cut a sample of each plant they found. They pinned them on a large piece of paper, identified and labeled them.

*Following individual interests*

The fifth-grade boys formed groups out of school and studied ponds, brooks and streams near their homes or in the neighborhood, to find out what forms of aquatic life there were in them. Several boys caught fishes, frogs, salamanders, and water bugs, and started aquaria at home. They also made notebooks in which they collected information about them.

*Collecting leaves*

On a walk through the woods the children collected as many different kinds of leaves and seeds as they could find. These were brought to the school, mounted and classified. The children discussed why leaves fall from the trees; what happens to the trees when the leaves fall, and how the tree growth is shown by growth rings.

*Wiring a play theater**

One fifth-grade class has been working on electricity. This project started with the making of a small theater for giving weekly plays

in the classroom. The children learned how to wire the theater for lighting, and then followed up this study by wiring bells, making receiving sets, and building a storage battery.

There are many things children are interested in doing which involve scientific meanings. Many of these things may be initiated by the children, others may be things which children are doing which gives the teacher an opportunity to assist them in gaining a better understanding, or they may be things which children are interested in doing once they are suggested to them.

*Growing unusual plants*

One of the girls brought a pitcher plant to school. She told about it and left it for the children to watch. Some time later the teacher talked with the children about other interesting plants. They brought different kinds of cacti to school. They gathered tiny plants, from the brook, and planted seeds of the arrow-head in a water jar. Another room gave them a root of papyrus to plant. They grew some rice plants. From these experiences the children learned about widely contrasting conditions under which different plants grow.

*Feeding the birds*

Our class is helping the birds. We got the idea from the radio. We appointed a committee to go outside and scatter the food. First we dug a hole in the snow then we scattered the food. We have asked the kindergarten children to tell us if they see any pretty birds come to our feeding station. We have noticed that the birds have eaten all the food and we are in hopes of seeing some pretty birds. (Written by a fifth grade pupil.) The children in this group became very much interested in birds. They kept a record of birds they saw, learned about bird's habits, how to attract birds to their homes, went on bird walks, and read different bird books.

*Observing nature changes*

Some second grade children tied their marker to a branch of a tree which they observed from day to day. As they reported changes which they noted their comments were written on the observation sheet record by the teacher.

*Studying hibernating insects*

In the fall one of the children brought in a praying mantis. A few days later there was an egg sac in the terrarium in which they had placed the insect. This started the children to collecting different kinds of cocoons and egg cases. They looked up information about them, labeled them and kept them until spring when the insects hatched.

*Finding out about air pumps*

The pump that the children used for their bicycles failed to work. The discussion of some of the boys was overheard by the teacher who suggested bringing the pump in for examination. Some of the boys were well acquainted with the inside mechanism of a pump but none of them knew just how and why it worked. After learning how the pump worked they discussed what qualities in the leather would make the best working pump. They also discussed how pumps could be made to pump more air at a time; why some pumps have two cylinders, and how a pump could be made to pump air out of anything instead of into it. Later they tried out a vacuum pump and made many interesting observations on the queer characteristics of a vacuum on fire, on sound transfer, and its pressure effects.

*Growing a vegetable garden**

A group of older children decided that they could raise vegetables and use them to supplement their lunches at school. They discussed with the agricultural specialist what was best to grow and how to grow it. The first problem was to prepare the ground for planting. The space available had not been used for garden purposes before. The boys soon discovered the task of plowing the garden was too difficult for them. It was suggested that they could get help from their fathers. There was to be a meeting of the Parent-Teachers Association the following week so it was decided to enlist the help of the fathers on this occasion. Much time was spent during the week practicing the speeches to be made at the meeting. The child whom the others finally chose to represent them at this meeting stated the case so well that there was plenty of help offered. Enough potatoes, carrots, and beets were raised to provide one hot dish for every child who stayed for lunch all year. The Home Economics department cooperated in the preparation and serving of the vegetables each day.

*Helping needy families*

Children in another school who were helping needy families in their community grew vegetables in their school garden to send them.

Science is becoming more and more a part of other schoolroom activities. It is brought in as part of units in other fields whenever it helps to make any leads that arise within the units more meaningful.

This emphasis does not regard science as a separate subject but as related to and as a natural and inherent part of experience and learning.

*Making a school museum*

The seventh-grade class took charge of the school museum. They used the large basement room and arranged cases and tables for exhibits. They decorated the walls to show stellar phenomena, important scientific discoveries and inventions, and possible fields of future scientific interest. The children invited other classes and individual children to arrange exhibits. Each week they ran a feature exhibit which they especially advertised. The seventh-grade children acted as guides and told interesting things about the exhibits.

*Studying ways of keeping time*

Some children in the third-grade group were studying man's methods of keeping time. They made a water clock, a sand clock, and colored candles and noted the time of burning. They saw a collection of valuable, old wooden clocks. The school janitor explained to them how the electric clock in the school worked.

*Discussing current scientific events*

The children set aside one of their news periods for discussing current scientific events. The most interesting of the articles reported were put in a class science book. Different children illustrated colored background pages for the articles suggested by their content. The clippings from *The New York Times* for a typical week included material about preserving native plants, shrubs, and trees; a report of the meeting of The American Chemical Society; pictures of museum excavations at Ur; the story of the making of the giant lens for the world's greatest telescope; a description of rare specimens acquired by the American Museum of Natural History; of tapping the ocean's gold treaure; the arrival of the circus train; the contributions to science of the "fog camera"; the possible relation between organic chemistry and advanced race development; the latest discoveries about the atom; pictures showing the effect of winter weathering on roads; research to determine the connecting link between the Indians of Arizona and Mexico; radio news about broadcasting accomplishments between Little America and New York; the National Geographic Society award for distinguished service; the discoveries with giant telescopes that extend the conceptions of the universe; and the epic of Admiral Peary's great adventure to the North Pole retold by Captain Robert A. Bartlett.

*Exploring the stratosphere*

A group of boys who were interested in following Piccard's flight made up conversation to use in dramatic presentation of the event that would give the class a notion of the preparation for the flight, the take-off, the scientific instruments used, the discoveries made, and the descent.

*Representing old science notions*

Old science notions interested a group who were studying exploration. This sixth grade searched old stories and texts for things which people of the past believed that are contradictory to our present scientific beliefs. Some of the superstitious beliefs about man, animals, and monsters lent themselves to pictorial representation. For example one chart showed the giant Atlas holding the world on his shoulders and standing on the back of a huge tortoise; another a flat earth with the sun circling around it; giants who were believed to have lived on the earth; and fierce land and sea demons.

*Visiting the water tower*

Everyone was present to enjoy the excitement of the trip to the pumping station where the head of the village water department was to show the children where the village got its water. In the most interesting manner all questions were answered. "How much water goes through the pipes in a second?" "Where does the water come from?" "What makes the pipes so cold?" "Why do they shake so?"

After careful examination of the machinery and pipes upstairs and down, and watching the throwing of the switches, a quarter of an hour was spent in observing fungi through the microscope and discussing methods of purifying water. Outside, everyone climbed up the grass covered viaduct and lay down on top of the hatchway to see the water far below.

Some science interests run cross-sectional as far as grade levels are concerned.

*Organizing inter-class science groups*

The school organization is such that it is possible to form inter-class groups with like interests. There is an astronomy group made up of children interested in finding out about the stars; a group that is interested in doing experiments noting chemical changes; another group interested in photography who are developing pictures; and an outdoor group who are studying rocks, making trips for finding, collecting, identifying and classifying them.

With the trend in grade practice toward the inclusion and extension of science

wherever it interprets child experience, the teacher finds it necessary to recognize science experiences that enter into child life and have available many materials and sources that would further children's scientific learnings. These science excerpts from classroom practice and the enumerated materials are suggestive of possibilities in this direction.

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[1] *Cardinal Objectives in Elementary Education: Trends in Unit Teaching.* Bulletin No. 4. Albany, New York: University State of New York Press, 1933.

# STATUS OF COLLEGE AND UNIVERSITY OFFERINGS IN THE TEACHING OF SCIENCE*

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*Departments in Which Courses are Given*

In practice, several different answers are found to the question: Who should teach the courses in the teaching of science? Shall it be a man whose primary interests are in education or one attached fundamentally to natural science? If the institution is an independent or semi-independent school or college of education, its instructors are presumably of the former type; if it be a small liberal-arts college maintaining but one professor of education, instructors for "special methods" courses are usually drawn from the subject-matter departments. Between these two extremes with respect to emphasis on professional education lie colleges having more or less definitely organized departments of education and universities maintaining schools of education or college of education. With such institutions the practice is variable, "special methods" courses being sometimes entrusted to an instructor in the school or department of education, sometimes to a teacher in the subject-matter field. Even within the same institution, both plans are sometimes found in operation. Which plan may be expected to produce superior results is not within the scope of this study. It is a question that merits an investigation.

This study does attempt to obtain a picture of the present practice of colleges and universities in the assignment of their courses in science teaching. Difficulty was occasionally experienced in determining from catalogue statements what the status of the science-teaching course is. In most instances the department in which the course is given was specifically stated; in others it had to be inferred merely from the course number as Ed. 122, or Bot. 64; in a few instances even the course designations were ambiguous. In cases in which no evidence was supplied, the courses were eliminated from consideration.

Three types of course status were recognized: (1) course belonging definitely to the education department, (2) course taught by a member of a subject-matter department, (3) responsibility for course divided between education and subject-matter departments. According to the third arrangement, students enrolled in a course in the teaching of special subjects in charge of an instructor in education, but did at least a part of the course work in a section in charge of an instructor in a department. In Tables III and IV these types of status are designated respectively as Education, Department and Mixed. In Table III the courses are grouped also according to size of institution in which they are offered into seven groups as follows: 500–999; 1000–1499; 1500–1999; 2000–2999; 3000–3999; 4000–4999; 5000 or more.

* Concluded from December, 1934, issue.

The figures are the total enrollment of post-secondary students in the regular September–June session. They enable the reader to compare practices in small, medium, and large institutions. Colleges of smaller enrollment than 500 were not considered. For convenience in making comparisons, the table also shows percentages, the base in each case being the total number of institutions in each respective size group.

Table III shows no marked tendency in the assignment of the courses under consideration. Of all courses included in the study almost the same number are found in education as in the departments. If the 6 mixed courses be counted in with departments, that plan has a slight preponderance, 53.4% of all cases. Approximately the same ratios hold for the smallest institutions as for the total, while in the group of large universities a marked preference is shown for the plan of entrusting such courses to education specialists. Too few cases occur in the intermediate groups to be very significant. When institutions with enrollments under 3000 are compared with larger ones, the contrasts are sufficient to establish the principle that, generally the smaller institutions tend slightly to a departmental plan, the larger ones to the education plan. These tendencies, however, are slight.

TABLE III

SHOWING NUMBER AND PERCENTAGE OF COURSES IN TEACHING OF SCIENCE IN COLLEGES AND UNIVERSITIES OF VARIOUS SIZES ASSIGNED TO SUBJECT-MATTER DEPARTMENTS OR DEPARTMENTS OF EDUCATION. (SEE TEXT.)

| *Enrollment of Institutions* | *Education* | | *Department* | | *Mixed* | |
|---|---|---|---|---|---|---|
| | *Number* | *Percent* | *Number* | *Percent* | *Number* | *Percent* |
| 500– 999 | 21 | 45.6 | 22 | 47.8 | 3 | 6.5 |
| 1000–1499 | 3 | 33.3 | 5 | 55.5 | 1 | 11.1 |
| 1500–1999 | 10 | 38.5 | 16 | 61.5 | | |
| 2000–2999 | 2 | 28.6 | 5 | 71.4 | | |
| 3000–3999 | 7 | 50.0 | 7 | 50.0 | | |
| 4000–4999 | 2 | 40.0 | 3 | 60.0 | | |
| 5000–over | 23 | 59.0 | 14 | 35.9 | 2 | 5.1 |
| 500–2999 | 36 | 40.9 | 48 | 54.5 | 4 | 4.5 |
| 3000–over | 32 | 55.2 | 24 | 41.4 | 2 | 3.4 |
| All | 68 | 46.6 | 72 | 49.3 | 6 | 4.1 |

In connection with other portions of this study correspondence was carried on with a large number of instructors in courses in the teaching of science. Some of their expressions are difficult to reconcile with a professional attitude towards the study and problems of teaching. One instructor states that he has never had a course in education in his life and cannot understand its technical terminology. Another points out the study of educational "objectives" as material through the inclusion of which our "educational system is becoming devitalized and useless." It is noteworthy that all such expressions of an attitude definitely out of sympathy with the study of education emanated from instructors giving a course in the teaching of one of the sciences and belonging to a subject-matter department. We hasten to add that many instructors in departments as well as education manifest an attitude highly cooperative and professional. The correspondence files of this study do not justify a conclusion as to whether "teaching" courses should be given by an education or a departmental instruc-

tor, but they do indicate that when the latter plan is followed great care should be exercised in selecting the instructors.

In the types of courses offered as education courses and those offered as science courses, some differences are found. When 146 science teaching courses are divided according to the particular field of science to which they are devoted as well as according to the department offering the course, a distribution occurs as shown in Table IV.

This table indicates that courses which are adapted to special fields of science such as botany, chemistry, *etcetera,* are commonly offered in their respective departments although they are found with considerable frequency also in education departments.

Table IV

Showing Courses in the Teaching of the Various Science Fields Offered in Departments of Education (Education), Subject - Matter Departments, (Department), and Both Cooperating, (Mixed)

| *Special Field* | *Education* | *Department* | *Mixed* |
|---|---|---|---|
| Botany | 1 | 9 | 0 |
| Zoology | 1 | 7 | 0 |
| Physiology | 1 | 1 | 0 |
| Biology | 8 | 17 | 1 |
| Chemistry | 6 | 14 | 1 |
| Physics | 3 | 15 | 1 |
| Physical Science or Physics and Chemistry | 8 | 3 | 0 |
| Geography | 0 | 2 | 0 |
| General Science | 8 | 2 | 0 |
| Science | 32 | 2 | 3 |
| Total Undifferentiated (General Science & Science | 40 | 4 | 3 |
| Total Differentiated (All others) | 28 | 68 | 3 |
| Total | 68 | 72 | 6 |

Undifferentiated courses, science in general and general science, are given much more frequently by instructors in the education departments, or schools, the ratio being 10 to 1. The same tendency appears within the field of physical science, the courses in the teaching of physics or chemistry separately being divided between education and departments as 9 to 29, while the combined physics and chemistry course is given more frequently by an education instructor in the ratio of 8 to 3. The same tendency is present, the less marked, with the courses in the teaching of biological science. Courses in the teaching of botany, zoology, and physiology separately number 20, of which all but three are given by departments. Of 25 courses in teaching biology as one subject the departments offer 17, and education 8.

### Names of Courses

The name or title of a course is of less importance than its content. Uniformity of practice in naming courses of identical or similar content does, however, make for convenience in effecting transfer of students from one institution to another or in any other matter in which a comparison of the courses of two or more institutions is necessary. In the compilation of data set forth in this chapter, the names by which courses in teaching science are designated could be noted without great difficulty. They are of interest in showing a wide variety of practice and of some small value in indicating the variation of emphasis among the various courses.

The most striking features of the list of course titles are their length and the low frequencies. No single course title is used more than eleven times and even among these eleven there is some variation in the use of the article and preposition. Forty-five titles are used once each. Sixty-seven different titles are used to designate these 150 courses in the same general field.

Naturally, courses in teaching the different science subjects must have their own respective designations, but within each particular subject the variation in practice of course naming is large.

When differences arising from naming of the special sciences are eliminated and other

variations of a minor character are disregarded, these 150 course titles can be grouped into the 12 classes shown in Table V. Here substantial frequencies occur, with one form of title used in over half of all the cases. The Teaching of Science (or The Teaching of Biology, *etcetera* is the dominant form of title. This form is commended by its brevity and scope of meaning. It does not suggest the limitation of content to any one phase of the teaching problem, such as methods, content, organization, objectives, *etcetera*.

While it is doubtful if the titles of these courses are even fairly reliable indications of the type of course content and emphasis, it is true that a few distinguishable types are suggested, each representing the point of view of the person who devised or adopted the title, with respect to the nature of the course. These types, four in number, are shown in Table VI. In the first type the emphasis is on "Teaching." The term is an inclusive one, calling attention to the pedagogy of the subject but emphasizing no particular phase of it. The high frequency with which it occurs, 95 in 150, reflects the general favor it enjoys. "Methods," including "Special Methods," is a term used prominently in the designation of 17.3% of the courses. This type of nomenclature represents an emphasis upon a limited aspect of the problem of teaching not in harmony with the variety of content supported by the findings of other portions of this study. The third group in Table IV include a number of miscellaneous titles

TABLE V

FORMS OF TITLE USED TO DESIGNATE COURSES IN THE TEACHING OF SCIENCE. "SUBJECT" IS USED INSTEAD OF SCIENCE, ZOOLOGY, CHEMISTRY, *etcetera*. WORDS IN PARENTHESIS MAY BE OMITTED

| *Forms of Course Titles* | *Frequency* |
|---|---|
| (The) Teaching (of) Subject | 77 |
| (The) Teaching (of) High School Subject | 5 |
| (The) Teaching (of) Subject in {(the) High School / Junior & Senior High Schools / Secondary Schools} | 11 |
| The Teaching of Subjects in the United States | 2 |
| Methods {of teaching / in} (High School) Subject {in Secondary Schools / in High School} | 17 |
| Special Methods {in teaching / in / for teachers} (High School) Subject | 7 |
| High School / Professional } Methods-Subject | 2 |
| Materials and Methods of Teaching (High School) Subjects (in the High School) | 8 |
| Other titles suggesting Content, Organization, Methods, *etcetera* | 5 |
| Teachers (Training) (Course in) Subject | 14 |
| Subject for Teachers | 1 |
| Laboratory Course in Science Teaching Materials | 1 |
| Total | 150 |

TABLE VI

TYPES OF COURSES INDICATED BY TITLES. CONDENSED FROM TABLE V

| | *Types of Course* | *Frequency* | *Percent of Whole Number* |
|---|---|---|---|
| 1 | "Teaching" Courses | 95 | 63.3 |
| 2 | "Methods" Courses | 26 | 17.3 |
| 3 | Courses involving Method, Content, Organization | 13 | 8.7 |
| 4 | Teachers Courses in Subjects | 16 | 10.7 |
| | Total | 150 | 100. |

such as *Materials and Methods of Teaching Science,* Science in the High School, *etcetera,* which possess no advantage over those of the first group and lack their brevity. The 16 course titles in the fourth group contrast with all the others by throwing emphasis on science content. They are usually found in science departments and seem to be designed as science courses rather than education courses.

### CREDIT ALLOWED

The Committee on the Teaching of Science of the National Society for the Study of Education recommends a 4-hour "professional course in major subject."[7] Present practice falls short of this recommendation. Table VII shows 126 courses distributed with respect to the credit hours allowed to each and also with respect to the field of science to which they belong. Slightly more than half of the whole number are 2-hour courses. Almost 30% are found in the 3-hour group. The remaining 19% are scattered in other groups from one to eight. The average credit allowance for all courses is 2.3 hours; the averages in the various fields deviating not more than ½ hour from this general average. As would be expected the average credit allowance for courses in the teaching of science as a whole is appreciably greater than the average of courses in any more narrowly limited field, but this average is only 2.8 hours. These findings are in substantial agreement with those reported by Bachman.[1]

In consideration of the high value rating assigned to this course by teachers reporting for this and other studies, a larger time and credit allowance than that indicated here seems desirable. Revision of present prevailing practice in the direction of the recommendation of the Committee on Science Teaching may well be one of wholesome results of the Thirty-first Yearbook.[8]

TABLE VII
126 COURSES IN SCIENCE TEACHING DISTRIBUTED ACCORDING TO THEIR PARTICULAR FIELDS AND THE SEMESTER-HOUR CREDIT ALLOTTED TO THEM

| *Division of Science with which Courses Deal* | *Number of Courses Carrying Semester Hour Credit in the Amount of:* | | | | | | | | *Average* |
|---|---|---|---|---|---|---|---|---|---|
| | *1 Hr.* | *2 Hrs.* | *3 Hrs.* | *4 Hrs.* | *5 Hrs.* | *6 Hrs.* | *7 Hrs.* | *8 Hrs.* | |
| Science | 2 | 14 | 12 | 2 | | 2 | | 1 | 2.8 |
| General Science | | 4 | 2 | | | | | | 2.3 |
| Biology | | 14 | 7 | 2 | 1 | | | | 2.6 |
| Division of Biology, e.g., Botany | 4 | 10 | 2 | | | | | | 1.9 |
| Physical Science | | 6 | 4 | | | | | | 2.4 |
| Physics | 1 | 7 | 6 | 1 | 1 | 1 | | | 2.5 |
| Chemistry | 3 | 8 | 4 | 1 | 2 | | | | 2.5 |
| Geography | | 2 | | | | | | | 2.0 |
| Total | 10 | 65 | 37 | 6 | 4 | 3 | | 1 | 2.3 |
| Percent of Total | 8.0 | 51.6 | 29.4 | 4.8 | 3.2 | 2.4 | | 0.8 | |

Note.—Courses allowed variable amounts of credit are classed as receiving the maximum allowance. Fractional numbers of credit hours are classed with the next higher integral group, if the fraction is ½ or greater; if less than ½, with the next lower group.

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[5] Reports of the United States Commissioner of Education and Biennial Surveys of the Office of Education.

[6] "Statistical Summary of Education." *Office of Education, Bulletin No. 3, 1930.*

[7] *Op. cit.*

[8] National Society for the Study of Education, *Thirty-first Yearbook*, Part I, "A Program for Teaching Science." Bloomington, Illinois: Public School Publishing Company, 1932. p. 342.

# THE SELECTION OF SCIENCE PRINCIPLES SUITABLE AS GOALS OF INSTRUCTION IN THE ELEMENTARY SCHOOL*

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The total list of principles in the criteria for the selection of raters was incorporated into a rating sheet and sent to teachers of elementary science. The instructions that accompanied this rating sheet follow:

The following list of principles is a composite one revealed by available published and unpublished reports of analyses. This list was fitted to a specific set of criteria by a jury meeting in a series of panels and later was critically revised and extended by a subject-matter specialist in each major field of science.

It is likely that some of these principles are appropriate as the *ultimate goals* or outcomes of science in the grades one to six inclusive.

One way of determining the extent of the suitability of those principles for inclusion as ultimate goals of instruction in elementary science is through securing a composite rating of the principles by experts in the teaching of science in these grades.

I am, therefore, soliciting your help in this rating. Will you please indicate your judgment of the suitability of the following principles as ultimate goals of elementary-science instruction by marking each in the appropriate column in accordance with the following code:

(1) Not at all suited; (2) Poorly suited; (3) Neither well nor poorly suited; (4) Well suited; (5) Ideally suited. For example, let us assume that you consider a principle such as, "Effect follows cause" to be well-suited as a major goal of elementary-science instruction. You would, therefore, check it thus:

| *Principle* | *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|---|
| Effect follows cause ..... | | | | x | |

Your cooperation is personally appreciated.
(Signed) M. L. ROBERTSON

* Concluded from February, 1935, issue.

As the rating sheets were received, fifteen in number, the rating given to each principle by each rater was tabulated upon a suitable form. Table I is a model of the method used in tabulating the data from these sheets.

TABLE I
MODEL OF THE TABULATION FORM USED TO SECURE A COMPOSITE RATING*

| *Principle* | *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|---|
| Chemistry | | | | | |
| I. Atoms of all elements are made up of nothing but negative and positive electricity; the differences between atoms of different elements are due to the number of protons and electrons in the nucleus and to the peculiarity of the shell of excess electrons surrounding the nucleus ..... | 11 | 1 | 3 | | |
| 1. Atoms with few electrons in the outer circle are metals, those with nearly eight electrons are non-metals ..... | 15 | | | | |
| 2. Elements are made up of small particles of matter called atoms which are alike in the same elements but different in other elements | 2 | 4 | 4 | 5 | |

* This table is interpreted thus: of the fifteen experts who rated the principles, eleven expressed their judgment that this principle was not at all suited, one expressed an opinion that it was poorly suited, and the remaining three, that it was neither well nor poorly suited as an ultimate goal of science instruction in the grades.

From these data it was then possible to determine which of the principles were deemed by these raters to be suitable to the elementary grades. The median rating for each principle was determined. The principles were ranked from the highest to the lowest on the basis of these median values.

The mid-point of a five-point scale can be defined as existing at a point halfway through the third interval.* The writer assumed there would be an equal opportunity for those principles given a rating in the third interval to be suitable as to be unsuitable. Utilizing this assumption, he arbitrarily decided to include in the final list as suitable all those principles which had received a median rating between 2.51 and 4.99. Practically, this plan resulted in counting eight ratings from the right-hand side of the scale towards the left-hand side. Whenever the sum of half the ratings at 3 plus those at 4 and 5 amounted to 8.0 or more, the principle was deemed suitable for inclusion as one of the ultimate goals of instruction in elementary science.† There were 113 such principles, which are given in the following list:

ONE-HUNDRED-THIRTEEN PRINCIPLES OF SCIENCE SELECTED BY FIFTEEN ELEMENTARY-SCIENCE SPECIALISTS AS SUITABLE FOR GOALS IN THE ELEMENTARY SCHOOL

I. All matter is composed of single elements or combinations of several elements and can be analyzed by chemical processes and divided into these units.

II. All substances are made up of small particles called molecules, which are alike in the same substance but different in other substances.

III. The material forming one or more substances, without ceasing to exist, may be changed into one or more new and measurably different substances.
1. Elements or compounds may combine to form other substances.

IV. Every pure sample of any substance, whether simple or compound, under the same conditions will show the same physical properties and the same chemical behavior.

V. No chemical change occurs without an accompanying energy change.

VI. Things happen according to law; effect follows cause and to every action there is an equal and opposite reaction.

VII. Matter and energy may be transformed but they cannot be created or destroyed.
1. The work obtained from a machine never exceeds the work put into it.

VIII. Certain energy forms travel in waves.

IX. Waves travel in straight lines while passing through a uniform medium.
1. Light travels in straight lines in media of uniform density.

X. Radiant energy travels through space in all directions undiminished.

XI. When waves strike an object, any one or more of the following may happen to them: they may be absorbed, transmitted, or reflected.

XII. Ready absorbers of energy are ready radiators, while slow absorbers are slow radiators.

XIII. Dark, rough, or unpolished surfaces absorb or radiate energy more rapidly than light, smooth, or polished surfaces.
1. The darker the surface is, the better it absorbs light.
2. When light rays are absorbed, some of the light energy is transformed into heat energy.

XIV. Whenever an opaque object intercepts radiant energy rays, a shadow is cast behind the object.

XV. If a beam of light falls on an irregular surface, the rays of light are scattered in all directions.

XVI. An image appears to be as far back of a plane mirror as the object is in front of the mirror, and reversed.

XVII. When waves pass obliquely from a rare to a denser medium, they are bent or refracted toward the normal; and when they pass obliquely from a dense to a rarer medium they are bent away from the normal.

* The third interval was labeled "neither well nor poorly suited." For statistical purposes the following class intervals were assigned to the five points on the sheet: 0–.9, 1.0–1.9, 2.0–2.9, 3.0–3.9, 4.0–4.9.

† This latter method in practice secured two principles in addition to those secured by the statistical technique described.

1. Light rays may nearly always be brought nearer together, converged or focused by convex lenses, and diverged by concave lenses.
2. Ordinary light is made up of waves of many different wavelengths and each one is bent, or refracted, to a different degree, so that the various colors of which the light is composed are spread out in a band of colors known as the spectrum, the red being the least refracted, the violet the most.
3. The colors of objects depend upon what light rays they transmit, absorb, or reflect.

XVIII. All matter may change its state by absorbing or releasing energy.

XIX. The average speed of molecules increases with the temperature.

XX. Compression of a gas increases its pressure.

XXI. Heat is liberated when a gas is compressed, and is absorbed when a gas expands.

XXII. Gases may be converted into liquids by reducing the speed of their molecules.

1. All gases must be cooled to or below a certain temperature in order to be liquefied.

XXIII. When a liquid is changed to a gas, heat is absorbed; when a gas is condensed to a liquid heat is liberated.

XXIV. Gases expand with heat and contract with cold as do most liquids and solids.

XXV. Different parts of the same substance will expand different amounts according to the amount of temperature change produced.

XXVI. A gas always tends to expand throughout the whole space available.

XXVII. Pressure exerted by a confined gas always increases with the temperature and *vice versa*.

XXVIII. If the same pressure is maintained, the volume of a gas varies directly as the temperature.

XXIX. The boiling point of any solution becomes lower as the pressure is decreased and higher as the pressure is increased.

XXX. A body immersed or floating in a liquid is buoyed up by force equal to the weight of the fluid displaced.

XXXI. Any substance that will dissolve in water will cause the resulting solution to boil at a higher temperature and to freeze at a lower temperature than pure water.

XXXII. Freezing point depression and boiling point elevation are proportional to the concentration of the solution.

XXXIII. The force of attraction or repulsion between two magnetic poles varies directly as the pole strength and inversely as the square of the distance between the poles.

1. Like magnetic poles always repel each other, and unlike magnetic poles always attract each other.

XXXIV. An electric current may be produced in three ways, by rubbing or friction, chemical action, and by using magnets.

XXXV. Like electrical charges repel and unlike electrical charges attract.

XXXVI. All materials offer some resistance to the flow of electric current and that part of the electrical energy used in overcoming this resistance is transformed into heat energy which when intense enough produces light.

XXXVII. The amount of heat which a body acquires when its temperature rises a given amount is identical with the amount it gives off when its temperature falls by that amount.

XXXVIII. As heat tends to diffuse and thus equalize temperatures of all places and objects with which it comes in contact, there is a continuous transfer of heat between bodies of different temperatures.

1. The rate of heat transference increases with the difference in temperature between the heated body and the receiving body.

XXXIX. The lower the temperature of a body, the less the amount of energy that it radiates; the higher the temperature the greater is the amount of energy radiated.

XL. The principal cause of wind and weather change is the unequal heating of different portions of the earth's surface by the sun, thus all winds are convection currents caused by unequal heating of different portions of the earth's atmosphere and they blow from places of high atmospheric pressure to places of low atmospheric pressure.

1. Air has a tendency to move from a region of higher pressure to one of lower pressure; the greater the difference the faster the movement.
2. In the Northern hemisphere great volumes of air revolve in a counter-clockwise direction, and in the southern hemisphere they revolve in a clockwise direction.

3. Bodies of land heat up and cool off more rapidly and more readily than bodies of water.

XLI. The more nearly vertical the rays of radiant energy, the greater the number that will fall upon a given area, and the greater is the amount of energy that will be received by that area.

XLII. The atmosphere of the earth prevents the heat of the earth's surface from escaping and the earth begins to cool only when the amount of heat lost during the night exceeds that gained during the day.

XLIII. The higher the temperature of the air the greater the amount of moisture required to saturate it.

XLIV. The pressure of air decreases with an increase in water vapor content, other things being equal.

XLV. The pull of gravity is proportional to the mass of the body and inversely proportional to the square of the distance between their centers of mass.

XLVI. All bodies in our solar system are controlled by the gravitational attraction of the sun, about which they revolve in huge ellipses and in nearly the same plane.

XLVII. Movements of air, water, and solids on the earth are due to gravity plus rotation of the earth.

XLVIII. Any body of liquid free to take its own position will seek a position in which all surfaces lie on the same horizontal plane.

XLIX. A body at rest or in motion will remain at rest or continue in motion in a straight line until some force acts upon it.

L. Bodies in rotation tend to fly out in a straight line which is tangent to the arc of rotation.

LI. The amount of momentum possessed by an object depends upon its weight and speed of motion.

LII. Whenever one surface is moved over another surface there is always friction (resistance to motion) which always results in the transformation of some of the mechanical energy of the moving object into heat energy and in the wearing away of some of each surface.

LIII. Sound is produced by vibrating matter and is transmitted by matter.

1. The higher the pitch of a note, the more rapid the vibrations of the producing body.
2. The greater the space through which a body vibrates the louder will be the sound it produces.
3. Musical tones are produced when a vibrating body sends out regular vibrations to the ear, while only noises are produced when the vibrating body sends out irregular vibrations to the ear.

LIV. The environment acts upon living things and living things act upon the environment.

LV. The cell is the unit of structure and function in all organisms.

LVI. Food, oxygen, certain optimum conditions of temperature, moisture, and light are essential to the life of most living things.

1. Before the seed that is planted in the soil can germinate, three factors must be present, oxygen, water, and heat.

LVII. Circulation is carried on in all living organisms.

LVIII. The more complex organisms have been derived by natural processes from simpler ones, these in turn from still simpler, and so down to the first living forms.

LIX. From the lower to the higher forms of life, there is an increasing complexity of structure and this is accompanied by a greater division of labor.

LX. Life springs from life and is subject to the same cycle of life: birth, youth, and dissolution.

LXI. Species not fitted to the conditions about them will not thrive and finally will become extinct.

1. The transfer of micro-organisms from infected to non-infected individuals may be prevented by (a) destroying; (b) preventing infection of carriers; (c) disinfection and destruction of carriers; (d) retarding the multiplication of infecting organisms through conditions inimical to their life; (e) establishment of immunity in individuals subject to infection.
2. Certain bacteria escape adverse conditions by forming highly resistant spores which survive them.

LXII. The chief differences in the structure of organisms from the lowest to the highest area resultant of the means adopted to perform certain functions under different exigencies imposed by the environment and the mode of life.

LXIII. All living organisms have the common life processes—reproduction, growth, nutrition, excretion, respiration, and irritability.
1. The power of reproduction is one of the characteristics of plants and animals, but the modes of reproduction vary.
2. In most mammals the fertilized eggs are held within the body of the mother where they grow until the embryos develop and are ready to be born; the young after birth are nursed for a variable period of time on milk secreted by the mammary glands.
3. Pollen will germinate on the stigmas of flowers of the same kind on which it grew and rarely on those of flowers which are nearly related to it.
4. To meet certain conditions of the environment, or, in a struggle for existence most plants and some animals have adopted both asexual and sexual reproduction.

LXIV. The plants and animals in a given environment are mutually interdependent.
1. The oxygen of the atmosphere is removed by animals and replaced by green plants.
2. Since other organisms constitute an important part of the environment of every living thing it is true that there is a complex web of life, an interdependence of organisms producing a nice balance of nature.
3. Bacteria by means of enzymes which they produce cause chemical changes in the substances from which they secure their nutrition; thus fermentation, putrification, decomposition, and decay are largely the results of bacterial processes that restore to the atmosphere and the soil substances which plants and animals use in their vital processes.
4. Certain associations are the result of a struggle for survival, *i.e.*, commensalism, community or social life, and parasitism.

LXV. During all life processes there is a building up and a tearing down of protoplasm with constant transformation of energy.

LXVI. The utilization of food in the body depends upon the heat liberated by its oxidation.

LXVII. Protoplasm may be nourished only by food substances which have been reduced to liquid form by enzymes.

LXVIII. In the presence of sunlight chloroplasts of green plants convert carbon dioxide and water into sugar and starch and liberate oxygen; thus directly or indirectly producing practically all the food in the world.

LXIX. The various kinds of food are used by the body in growing new cells, in rebuilding cells, in providing energy for the body activities, and in doing work.

LXX. All the higher forms of terrestrial life are dependent either directly or indirectly on the soil bacteria for their nitrogen intake.

LXXI. Protoplasm is the one essential constituent of every living thing, upon the peculiar properties of which the life of the organism depends.

LXXII. The energy which makes possible the activity of most living organisms came at first from the sun and was secured through oxidation of food within the organism.

LXXIII. The phenomena of life involve chemical change, so that wherever living processes are being carried on, chemical changes are taking place; however, chemical change may proceed without involving life.

LXXIV. Strata of rocks occur in the earth's surface in the order in which they were deposited; except in the case of overthrust faults.

LXXV. The present is the key to the past.
1. The succession of fossils in the rocks shows a progressive series from simple to complex.

LXXVI. Glacial conditions are approached by increasing latitudes or altitudes.

LXXVII. Streams have a regular cycle: youth, maturity, and old age.

LXXVIII. Two groups of forces are constantly acting on the earth's surface, one building it up, the other tearing it down.
1. Every stream is a part of a large drainage system which is wearing down the land surface.
2. What water breaks down in one place, it builds up at another.
3. Falls or rapids in a streambed will be formed wherever the stream flows over a hard stratum to a soft one.
4. When elevations or depressions are created upon the surface of the earth, the elevations are attacked by the agents of erosion

and the materials are carried to the depressions where sedimentary rocks are formed.

5. Deposition in the form of moraines is equal to the amount of the material which was removed by erosion.
6. Erosion takes place in proportion to the resistance of the rocks to decomposition and disintegration.

SUMMARY

This plan secures, by the technique herein described, 113 defensibly stated principles and subsidiary-principles appropriate to serve as ultimate goals of science teaching in the elementary school. In addition, the data secured indicate that:

1. In the pooled opinions of the 15 evaluators, many principles of science thus obtained are entirely unsuited as goals of instruction in the elementary school.
2. There is a wide range of opinion among these elementary science experts with respect to the suitability of the various principles.
3. There is a noticeable lack of uniformity among investigators with respect to the statement of principles.

# AN EXPERIMENT TO ILLUSTRATE MENDEL'S LAW

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There are not many experiments available for the illustration of Mendel's Law of Heredity in a single laboratory period. Reasons for this are that an extended period of time is usually involved in plant and animal breeding, and it is necessary to deal with large numbers if the results are not to be subject to the variations due to sampling.

For a number of years the writer has used the following coin tossing experiment to show how Mendel's ratios of 3:1 and 1:2:1 are determined. By means of this experiment individual and group scores can be obtained in a few minutes, each member of the class can take part and contribute to the results, and a grand total can be obtained which usually tallies very closely with the theoretical figures. Practice is given in the computation of ratios as they relate to Mendel's law, and in the use of such terms as dominant, recessive and hybrid. The experiment itself takes about one hour; additional time is needed for an explanation of Mendel's law.

A preliminary discussion on heredity is given as a background for the experiment. A diagram illustrating Mendel's law is explained to the class with special emphasis upon the make-up of the gametes of monohybrids. The two hybrids which give rise to the gametes are in the experiment represented by two coins. One coin, for example, a penny, can represent the male hybrid, and a second coin, for example a dime, can represent the female hybrid. The head and tail of each coin represent the two types of gametes of each hybrid, one of which stands for the dominant and the other for the recessive traits. The four gametes, two types of sperm and two types of eggs, offer four possible combinations to form the next generation: Dominant-Dominant, Dominant-Recessive, Recessive-Dominant, and Recessive-Recessive. But the D-R and the R-D combinations are identical in heredity make-up except that the D and the R traits in the two cases come from opposite parents; the Dominant in the first case is furnished by the male hybrid and in the second case by the female hybrid. The above explanations are necessary if the experiment is not to be simply a study on the laws of chance. The instructor can, of course, mention some other applications of chance, as, for exmple, to lotteries, when the experiment has been completed.

The procedure in the experiment is as follows. The students are paired up and

each pair is assigned a number for convenience in recording the results. Two coins are required in the study of monohybrids; more coins are needed if the experiment is to illustrate di- or trihybrids. Heads are to be called dominant and tails recessive. One of each pair will toss the coins and the other will keep the scores. The one student now shakes the coins in his cupped hands, places the coins on the table with a minimum of noise and calls out Dominant, Hybrid or Recessive as the case may be. The other student records the results under the respective headings. If desired, a separate count can be kept of the two types of hybrids, D-R and R-D, as previously described. Any number of tosses can be made, but an even one hundred tries lends itself more readily to computation and to inspection when checking with the theoretical answers.

In the particular experiment recorded in the accompanying table, two sections of students were used, one with thirty-four and the other with thirty-six students, making seventeen and eighteen pairs respectively. The first few pairs to complete their initial hundred tries were asked to toss a second hundred to give a total of twenty sets of numbers for each laboratory section. A total of two thousand tosses for each section was obtained in this way. The table indicates the individual results for each pair of students in section A, the combined score for each section, and the total score for both sections.

In computing the ratios one number must be assumed to be correct and from it in turn, the values of the other parts of the ratios are determined. The writer uses the total number of hybrids to represent the "two" in the ratio 1:2:1, and the total number of dominants to represent the "three" in the ratio 3:1. However, regardless of which number is assumed to be the correct one, the results are equally accurate, but the recommended procedure seems (to the student) to approach the theoretical results more closely—the resulting answers diverge from the theoretical by fractions and not by whole numbers.

The first number in the first ratio in the table is obtained by the use of the following formula—The number of Pure Dominants: The number of Hybrids:: X: 2. Substituting the first set of numbers in the table, the ratio now reads—46: 24:: 2: X. X equals 1.04. The theoretical answer is 1.00. The results should be calculated at least to two decimal places. The last number of the first ratio reads—The number of Hybrids: The number of Recessives:: 2: X. Substituting the first set of numbers, the ratio reads—46: 30:: 2: X. X equals 1.30. The completed ratio should approach in value Mendel's ratio of 1:2:1. This particular example now reads 1.04: 2: 1.30.

The second ratio reads—The total number of Dominants (including Pure Dominants and Hybrids): The number of Recessives:: 3: X. Substituting as before, the ratio reads—70: 30:: 3: X. X equals 1.29.

Each pair of students should compute their own results. The more mathematically-minded students can check the figures of others and determine the total for the class. A table has previously been arranged on the blackboard upon which the individual results are recorded as fast as they are available.

It should be pointed out to the class that the individual set or student scores may vary a great deal from the theoretical answers, but when large numbers are taken, the total results tend to approach the theoretical figures. Also, the number of individual results that is above the theoretical answer is usually nearly the same as the number that is below this answer. For example, in the second ratio the

scores of nine sets of tosses are above the theoretical answer, seven are below, and four are correct. The writer has the records of nine other large totals such as are illustrated in the table. The combined ratio for all of these tosses approaches very closely the theoretical answer.

A Demonstration of Mendel's Law by Means of Coin Tossing

| *Number of Student* | *Pure Dominant Head–Head* | *Hybrid Head–Tail* | *Pure Dominant and Hybrid* | *Recessive Tail–Tail* | *Ratio of Dominants: Hybrids: Recessives. Mendel's Ratio is 1.00: 2: 1.00* | *Ratio of Total Dominants: Recessives. Mendel's Ratio is 3: 1.00* |
|---|---|---|---|---|---|---|
| 1 .... | 24 | 46 | 70 | 30 | 1.04 : 2 : 1.30 | 3 : 1.29 |
| 2 .... | 31 | 49 | 80 | 20 | 1.27 : 2 : .82 | 3 : .75 |
| 3 .... | 27 | 46 | 73 | 27 | 1.17 : 2 : 1.17 | 3 : 1.11 |
| 4 .... | 25 | 49 | 74 | 26 | 1.02 : 2 : 1.06 | 3 : 1.05 |
| 5 .... | 22 | 61 | 83 | 17 | .72 : 2 : .56 | 3 : .61 |
| 6 .... | 22 | 51 | 73 | 27 | .86 : 2 : 1.06 | 3 : 1.11 |
| 7 .... | 32 | 49 | 81 | 19 | 1.31 : 2 : .78 | 3 : .70 |
| 8 .... | 25 | 45 | 70 | 30 | 1.11 : 2 : 1.33 | 3 : 1.29 |
| 9 .... | 30 | 45 | 75 | 25 | 1.33 : 2 : 1.11 | 3 : 1.00 |
| 10 .... | 32 | 46 | 78 | 22 | 1.40 : 2 : .95 | 3 : .85 |
| 11 .... | 30 | 43 | 73 | 27 | 1.40 : 2 : 1.26 | 3 : 1.11 |
| 12 .... | 20 | 50 | 70 | 30 | .80 : 2 : 1.20 | 3 : 1.28 |
| 13 .... | 30 | 45 | 75 | 25 | 1.33 : 2 : 1.11 | 3 : 1.00 |
| 14 .... | 22 | 54 | 76 | 24 | .81 : 2 : .89 | 3 : .95 |
| 15 .... | 25 | 50 | 75 | 25 | 1.00 : 2 : 1.00 | 3 : 1.00 |
| 16 .... | 28 | 49 | 77 | 23 | 1.14 : 2 : .94 | 3 : .90 |
| 17 .... | 21 | 53 | 74 | 26 | .79 : 2 : .98 | 3 : 1.05 |
| 18 .... | 15 | 60 | 75 | 25 | .50 : 2 : .83 | 3 : 1.00 |
| 19 .... | 20 | 51 | 71 | 29 | .78 : 2 : 1.14 | 3 : 1.23 |
| 20 .... | 22 | 54 | 76 | 24 | .81 : 2 : .89 | 3 : .94 |
| Total for Section A . | 503 | 996 | 1499 | 501 | 1.01 : 2 : 1.01 | 3 : 1.00 |
| Total for Section B . | 524 | 999 | 1523 | 477 | 1.05 : 2 : .93 | 3 : .95 |
| Total for Both Sections ..... | 1027 | 1995 | 3022 | 978 | 1.03 : 2 : .98 | 3 : .97 |

The students are cautioned against the use of the terms "Heads" and "Tails" when tossing the coins. Instead they should use the terms Dominant, Hybrid and Recessive, or actual traits such as Tall, Medium and Short, or Red, Pink and White. It is explained to them that the Medium and the Pink individuals will be in outward appearance like the Tall or the Red if Tall and Red are dominant traits.

Upon the completion of this coin experiment the class is given ears of corn which illustrate the ratio of 3 : 1, and others ears which represent the ratio of 1 : 2 : 1. The students record their own results as in the coin experiment and a grand total for the class is obtained. A single coin toss corresponds to a kernel of corn, each set of one hundred tosses corresponds to an ear of corn, and the total of a class of students corresponds to a large sampling of corn.

# THE EFFECT OF TEACHING STRESS UPON AN ATTITUDE

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This article attempts to tell, briefly, part of a story published in full elsewhere[1]—a study undertaken to determine the extent to which attitudes may be modified by stressing them in connection with teaching.

Previous work in this field comes to no definite conclusions. There are about as many studies reporting that the school influences attitudes as there are concluding that it does not influence attitudes.[2] There is little agreement in procedures or populations, and in few cases were specific attitudes selected and deliberately added to a curriculum. Very few experimenters have used subjects below junior-high-school age, in spite of the general agreement that attitudes are fairly well-fixed by the time the pupil enters the seventh grade. The predominant type of response is of the pencil-and-paper variety and few attempts are made to verify the attitude involved by measures of actual behavior.

The Baltimore Science Curriculum gives as one attitude to be striven for as an outcome of teaching in the intermediate grades the following: "A feeling of satisfaction in 'getting outdoors.' Example: A walk in the open in preference to a moving picture show."[3] This attitude was selected for experimentation. Two groups of intermediate grade children, of equivalent chronological age, mental age, educational age, economic status, and grade level were set up. In one group the teachers were instructed to stress this attitude in connection with science teaching in every way they could. The teachers of the other group were instructed merely to follow the regular course of study.

An attempt was made at some means of approximating actual behavior in the specific situation involved, viz., choice of outdoors in preference to a motion picture show. Two criteria were set up for this purpose. The first was a ballot, taken as a class vote, in which the children chose between the following options: a trip to the country, a moving picture show, and staying home. The choice was set for the Saturday following the day of the ballot, assuming it to be a "nice" day, and the expenses of the trip to the country and the picture show exactly the same. The percentages voting for each choice were recorded, and the same vote was repeated

TABLE I

RESULTS OF BALLOTS

COUNTRY

| | *Group X** | | | | *Group Y†* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Date* | *No.* | *%* | *P.E.‡* | | *No.* | *%* | *P.E.* | *Difference Favoring X* | *P.E. Diff.* |
| Oct. .. | 294 | 70 | 1.5 | | 367 | 69 | 1.4 | +1% | 1.8 |
| Jan. .. | 279 | 63 | 1.5 | | 275 | 65 | 1.6 | −2% | 1.9 |
| *Gain* .. | | −7 | 2.1 | | | −4 | 2.0 | −3% | 2.4 |

MOVIES

| | *Group X* | | | | *Group Y* | | | |
|---|---|---|---|---|---|---|---|---|
| *Date* | *No.* | *%* | *P.E.* | *No.* | *%* | *P.E.* | *Difference Favoring Y* | *P.E. Diff.* |
| Oct. .. | 89 | 21 | 1.4 | 111 | 21 | 1.2 | 0% | 1.8 |
| Jan. .. | 104 | 23 | 1.4 | 94 | 22 | 1.4 | −1% | 1.8 |
| *Gain* .. | | +2 | 2.0 | | +1 | 1.9 | −1% | 2.7 |

* The experimental group is referred to as Group X throughout the study.

† The control group is referred to as Group Y throughout the study.

‡ Percentages are considered whole numbers for convenience throughout these tables. Thus P.E.'s are correspondingly multiplied by 100.

at the end of the semester. The difference between the groups in change of percentages would then be attributable to the experimental factor.

As a second means of checking the changes in this attitude, the children were requested to keep brief diaries of their out-of-school activities for a two week period at the beginning of the experiment. This was also repeated at the end of the experimental period. The children were not aware of the primary purpose of these diaries, which was, of course, to determine the change in the number of times the child actually went outdoors in comparison with the times he went to the movies. The changes were determined by totalling the mentions of outdoors and movies and finding what precentage of the total mentions were outdoors and what percentage were movies. This was done at the beginning and at the end of the experiment.

Table I shows the results of the ballots. Initial percentages are almost identical and changes at the end of the semester prove to be very slight.

Table II presents results of analysis of the diaries of the two groups. The original groups revealed a significant difference in initial percentages, which cannot be accounted for except perhaps by the brevity of the period for which the diaries were kept. By reducing group X to 253 cases, the initial percentages are brought into fairly close agreement without seriously affecting comparative standings in other factors. There is a difference in gain of percentage of outdoors reported, which favors group X, but it is less than 3 P.E.

Some conclusions that might be drawn from these results are:

(1) Stressing preference of outdoors to movies in connection with science teaching does not significantly affect the percentage of times "going outdoors" is recorded in diaries kept for two-week periods, as compared with the number of times "going to movies" is recorded.

(2) The percentage of votes in a class ballot for a "trip to the country" in preference to a "trip to the movies" is likewise not significantly affected by this experimental procedure.

(3) The factor of season, or weather, apparently affects the ballots, *i.e.*, there is more voting for outdoors in October than in January. This appears in both groups. This trend is not shown in the diaries of the experimental group, which may be due to the experimental factor, as it appears in the diaries of the control group.

If the techniques used are valid, it would seem that factors not considered in the experiment play a larger part in this particular field than does what transpires in the classroom. Recent work by Thurstone and others[4] indicates that the movies them-

Table II
Results of Diaries, Equated Groups[1]
(Original X Group decreased by 97 cases in order to equate initial percentage.)

| | *Group X (N–253) Outdoors Movies* | | | | | *Group Y (N–350) Outdoors Movies* | | | | | *Diff. Fav. X* | *P.E. Diff.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Date* | *No.* | *%* | *No.* | *%* | *P.E.* | *No.* | *%* | *No.* | *%* | *P.E.* | | |
| Oct. .... | 193 | 37 | 224 | 63 | 1.5 | 255 | 39 | 401 | 61 | 1.2 | −2 | 2.0 |
| Jan. .... | 174 | 40 | 265 | 60 | 1.6 | 258 | 34 | 507 | 66 | 1.1 | 6 | 3.9 |
| *Gain in Outdoors* | | +3 | | | 2.2 | | −5 | | | 1.7 | +8 | 2.8 |

selves exert a great deal of influence on children's attitudes. There is a possibility that change in attitude is due to sheer maturation more than to the influence of the school, as Stephens [5] feels is the case with many changes hitherto assumed to be produced by the school.

Until more crucial work in this field is produced, the modification of an attitude in teaching would appear to be rather a dubious procedure.

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[1] Lichtenstein, A. *Can Attitudes Be Taught?* Johns Hopkins University Studies in Education No. 21. Baltimore, Md.: The Johns Hopkins Press, 1934.

[2] Lichtenstein, A. *op. cit.* Table I, p. 26 f.

[3] *Elementary Science Course of Study for Grades 4, 5, and 6.* Baltimore, Md.: City of Baltimore, Department of Education, 1929. p. 10.

[4] Payne Fund Studies. *Motion Pictures and Youth.* New York: The Macmillan Company, 1933.

[5] Stephens, J. M. *The Influence of the School on the Individual.* Ann Arbor, Michigan: Edwards Brothers, 1933.

## REJOINDER TO ARTICLE BY E. E. BAYLES ON "LIMITATIONS OF THE MORRISON UNIT" (DECEMBER, 1934, ISSUE)

In reading Mr. Bayles' article on Limitations of the Morrison Unit in the December, 1934, issue of SCIENCE EDUCATION, it is much easier to agree with him that there is no such thing as "the" principle of flotation than to agree that it would be in accordance with the Morrison philosophy either to set up flotation with its many principles as a unit in general science, or that the culmination of any unit in secondary education would mean the mastery of all the possible principles associated with such an idea as flotation. Flotation would more probably in general science be included in some unit as merely an element "so simple that it is hardly more than a trivial extension of the common experience of all pupils."

All through his discussion of the culmination of units, Morrison uses such expressions as "caught the central idea," and "caught the meaning and sense of the unit," as contrasted with the interpretation given by Mr. Bayles.

Further, it is difficult to understand whether Mr. Bayles objects to the principle teach, test, and re-teach as a satisfactory technique for arriving at the "central idea" or whether the achieving of the "central idea" or mastery is objectionable regimentation. Is it objectionable regimentation for the teacher of swimming to bring all of his pupils to the achievement of successful propulsion in water or for the teacher of algebra to succeed in having pupils achieve the "central idea" in the unit "Directed Numbers"?

On the other hand, what can any pupil slow or fast do with an idea until he has achieved a workable understanding of it? And does direct learning ever imply merely following directions? The technique of the use of the guide sheet is intended to bring both the slow and the rapid learner always nearer to independence in their acquirement of real learning. Any technique which fails to give the pupil appropriate learning situations for achieving that end and does not work toward producing a pupil who will "keep on growing" is at variance with the Morrison philosophy as it is generally interpreted.

Finally, whether or not Morrison himself in his discussion of direct teaching "oversimplifies the whole thing" may be decided from the following quotation: "These unit learnings cannot be measured but they can all of them be evidenced by symptoms or signs revealed in the learner's behavior. Some symptoms are plainly manifest if we observe thoughtfully; others can be detected only by tests designed to bring them out; others still can be observed only by the methods, and it may be only with the help of the instruments of the skilled psychologist."

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*New Jersey State Teachers College, Newark*

## BIBLIOGRAPHY NO. 1. SCIENCE REFERENCE MATERIALS FOR CHILDREN

### 2. GENERAL NATURE SERIES AND READERS

Brown, Elizabeth V. *Nature and Industry Readers.* World Book Co., Park Hill, Yonkers-on-Hudson, New York. 1930.

These three books are appropriate reading to supplement the science work. They contain series of stories of animals, entertaining stories of plants, and the development of transportation. Grades 4–6.

Stories of Woods and Fields, $1.00; Stories of Childhood and Nature, $1.00; When the World was Young, $0.80.

Duncan, F. Martin. *The Duncan Wonder Books.* Oxford University Press, 114 Fifth Ave., New York.

Four series comprising six volumes each. These illustrated books are full of information which is scientifically sound and written especially for children. They might serve as a course in nature study for grades 4–8. In cloth binding, $0.35; boards, each $0.55.

*Wonders of the Sea:*

(1) Wonders of the Shore; (2) The Lobster and His Relations; (3) The Star-Fish and His Relations; (4) Dwellers in the Rock-Pools; (5) The Sea Birds.

*Wonders of Insect Life:*

(1) Butterflies and Moths; (2) Bees, Wasps and Ants; (3) Beetles and Flies; (4) In Pond and Stream; (5) Curious Insects; (6) Spiders and Scorpions.

*Wonders of Plant Life:*

(1) The Story of the Plants; (2) Plants and Their Children; (3) Land and Water Plants; (4) Plant Traps and Decoys; (5) Some Curious Plants; (6) Plant Friends and Foes.

*Wonders of Animal Life:*

(1) Animal Life in the British Isles; (2) Animal Life in Africa; (3) Animal Life in the East; (4) Animal Life in the New World; (5) Bird Land; (6) Animal Friends.

DuPuy, William A. *Isn't It Odd?* D. C. Heath & Co., 231 West 39th Street, New York. 1930.

These two books describe nearly a hundred wonders of plant life and of animal life. Each oddity has been carefully checked for scientific accuracy. Illustrated with numerous black and white drawings. Two books. Grades 6–8. Each $0.88.

Wonders of the Plant World; Wonders of the Animal World.

Edwards, Paul Grey. *The Nature Activity Reader.* Little, Brown & Co., 34 Beacon Street, Boston, Mass. 1933.

This series was planned to meet the needs of the usual courses of nature study. Each book is divided into three parts—autumn, winter, spring; and in turn into birds, trees, animals, insects, and plants. The sections are supplemented by stimulating activities, riddles and tests.

Book I, Outdoor Land—Grade 1. $0.72.

Book II, The Outdoor Playhouse—Grade 2. $0.76.

Book III, The Outdoor World—Grade 3. $0.88.

Gehrs, John H. *Nature Study.* American Book Co., 88 Lexington Ave., New York.

These books bring to the child an appreciation of the order and system, the adaptations, and utilities of nature. They show him how man is dependent on nature and how he may develop the gifts of nature for his own use. Book Two emphasizes especially the economic and scientific phases of the subject.

Book One, Nature Study—Grades 5–6. $0.80.

Book Two, Nature Study—Grades 7–8. $0.80.

Hardy, Marjorie. *Sally and Billy Series.* Wheeler Publishing Co., 2831–35 South Parkway, Chicago, Ill. 1933.

This series of very simple little books is intended as supplementary nature reading for Grade I.

Sally and Billy, $0.20; Sally and Billy in Autumn, $0.20; Sally and Billy in Winter, $0.20; Sally and Billy in Spring, $0.20; Wag and Puff, $0.60.

Sharp, Dallas Lore. *The Dallas Lore Sharp Nature Series.* Houghton Mifflin Company, 2 Park St., Boston, Mass.

This series is planned for supplementary nature reading in the upper grades. Grades 6–9.

The Spring of the Year, $1.00; Summer, $1.00; The Fall of the Year, $1.00; Winter, $1.00.

SPEED, JAMES. *Billy and Jane, Explorers.* Two Volumes. D. C. Heath & Co., 231 West 39th St., New York. Book I, 1922—Book II, 1924.

The story of the discoveries of a boy and girl who learned to observe the birds, insects, plants, and animals that lived near them. The book contains a large amount of information. Illustrated.

Book I, Grades 2–3. $0.64.
Book II, Grades 3–4. $0.64.

BROWN, KATE L. *Alice and Tom.* D. C. Heath & Co., 231 West 39th St., New York. 1899.

This is a story of two happy children who really love flowers and trees. Illustrated. Grades 3–4. $0.96.

BRYCE, CATHARINE T. *That's Why Stories.* Newson & Co., 73 Fifth Ave., New York.

This book leads the child to an appreciation of the various special adaptations of animals through story form, for example, why the cat washes before eating, why the turtle stays near the water, *etcetera.* Grades 1–2. $1.20.

BURROUGHS, JOHN. *Afoot and Afloat.* Houghton Mifflin Co., 2 Park Street, Boston, Mass.

Camping with the President. A Tramp in the Catskills. A Summer Boating Trip. Illustrated with photographs. Grade 9. $0.44.

BURROUGHS, JOHN. *Birds and Bees.* Houghton Mifflin Co., 2 Park Street, Boston, Mass.

Bird Enemies. An Idyll of the Honey Bee. The Pastoral Bees. The Tragedies of the Nests. Grade 7. $0.28.

BURROUGHS, JOHN. *Nature Near Home and Other Papers.* Houghton, Mifflin Company, 2 Park Street, Boston, Mass.

Nature Lore, New Gleanings in Old Fields: Live Natural History, The Barn Swallow, Insects, The Dog, Wood Waifs, An Interesting Plant, Nature Near Home. Each After Its Kind, Nature Leaves: In Warbler Time, A Short Walk. In Field and Wood: Intensive Observation, From a Walker's Wallet. Grade 9. $0.44.

BURROUGHS, JOHN. *Sharp Eyes and Other Papers.* Houghton Mifflin Company, 2 Park St., Boston, Mass.

The Apple, Notes by the Way, Sharp Eyes, A Taste of Maine Birch, Winter Neighbors. Grade 9. $0.44.

BURROUGHS, JOHN. *The Wit of a Duck and Other Papers.* Houghton Mifflin Company, 2 Park Street, Boston, Mass.

The Wit of a Duck, The Downy Woodpecker, Bird Life In Winter, A Breath of April, An Astonished Porcupine, A Barndoor Outlook, A Bird's Free Lunch, The Woodpecker's Evening Hymn, Human Traits in the Animals, Wild Life in Winter, Bird-Nesting Time, The Coming of Summer. Grade 8. $0.44.

CARR, WILLIAM H. *The Stir of Nature.* Oxford University Press, 31 West 32nd Street, New York. 1930.

"A book of charm every student should know. Through Mr. Carr's guidance, young naturalists will be led to interpret the sights and sounds of nature."—*Los Angeles School Journal.* Grades 5–9. $1.75.

DISRAELI, ROBERT. *Seeing the Unseen.* The John Day Co., 386 Fourth Ave., New York. 1933.

The author tells of the things he discovered on the shore, in the woods, and in the air which he puzzled over as a child. It is given in simple language and well illustrated with enlarged microscopic photographs. For children 9 years old and older. $3.75.

FABRE, JEAN-HENRI. *Curiosities of Science.* D. Appleton-Century Co., 35 West 32nd Street, New York.

This book describes many interesting and unusual freaks of nature and varieties in the plant and animal worlds. Illustrated. Grades 5–6. $2.50.

HAWKES, CLARENCE. *The Trail to the Woods.* American Book Co., 88 Lexington Ave., New York.

This is told in story from bringing out important facts about wild animals, birds, and fish. Particular attention is given to the conspicuous traits which they have in common. Grade 5. $0.56.

HOLBROOK, FLORENCE. *The Book of Nature Myths.* Houghton Mifflin Company, 2 Park Street, Boston, Mass.

A second reading book designed to continue the vocabulary of *"The Hiawatha Primer."* It contains folk lore stories from many lands interpreting the phenomena of nature. Illustrated. Grades 2–3. $0.68.

HOLBROOK, FLORENCE. *The Hiawatha Primer.* Houghton Mifflin Company, 2 Park Street, Boston Mass.

The text is based directly upon Longfellow's "The Song of Hiawatha." Birds and squirrels and other wild creatures are an important part of the little Indian boy's world. Illustrated. Grades 1–2. $0.84.

HYLANDER, CLARENCE J. *The Year 'Round.* G. P. Putnam's Sons, 2 West 45th Street, New York. 1932.

A comprehensive and elementary nature guide designed for the child's use as well as for teachers and parents in answering the child's questions. With 51 line drawings. $2.00.

Lange, Dietrich. *Nature Trails.* D. Appleton-Century Co., 35 West 32nd Street, New York.

Sketches, based on the author's keen observations on farms and in city gardens and parks, which awaken the reader to the multitude of interesting things in nature on all sides. Illustrated. Grades 5–8. $1.20.

McCready, Samuel B. *Rural Science Reader.* D. C. Heath & Co., 50 Beacon Street, Boston, Mass. 1920.

The lessons create interest in rural life and respect for its opportunities and give suggestions for enlarging and enriching the economic and social resources of both pupils and parents. The style is attractive and the scientific data accurate. Illustrated. Grades 6–8. $1.12.

Mann, Paul B., and Hastings, George F. *Out of Doors—A Guide to Nature.* Henry Holt and Company, 2626 Prairie Avenue, Chicago, Ill. 1932.

This is in the nature of a text on the several phases of nature. It is designed to acquaint the pupil with animal and plant life, the earth and sky, and the nature phases of camp life. It is supplied with directions for experiments and other activities. Grades 5–7. $1.25.

Meyer, Zoe. *The Sunshine Book.* Little, Brown & Co., 34 Beacon Street, Boston, Mass. 1932.

A continuous story about a little boy and girl who find out many interesting things about the birds and animals in their garden. Told with short sentences, short paragraphs, and a simple vocabulary. Grade 1. $0.70.

Mills, Enos A. *The Story of a Thousand-Year Pine and Other Tales of Wild Life.* Houghton Mifflin Co., 2 Park Street, Boston, Mass.

The story of a "thousand-year" pine is as thrilling as fiction. Ring after ring in a cross-section of Old Pine's trunk yields the story of his growth. Other stories are: Dr. Woodpecker, Tree Surgeon, Beaver Pioneers, Beseiged by Bears, etc. Grade 8. $0.44.

Mosley, Edwin Lincoln. *Trees, Birds and Stars.* World Book Company, Yonkers-on-Hudson, New York.

This is an exceedingly interesting book in which the science idea is well integrated with the nature study idea. It will serve well for nature study and also as a fine supplementary reader for general science. Grades 7–9. $1.80.

Muir, John. *The Boyhood of a Naturalist.* Houghton Mifflin Company, 2 Park Street, Boston, Mass.

Selected chapters from The Story of My Boyhood and Youth. A New World, Life on a Wisconsin Farm, A Paradise of Birds, Young Hunters, are some of the themes. Grade 9. $0.44.

Parker, Bertha Morris, and Cowles, Henry Chandler. *The Book of Plants.* Houghton Mifflin Company, 2 Park Street, Boston, Mass.

This book gives pupils, in a vocabulary well within their range and in a style in which accuracy is not sacrificed, those fundamental ideas about plant life which are interesting to and easily comprehended by boys and girls. Illustrated. Grades 6–8. $0.88.

Patch, Edith M. *First Lessons in Nature Study.* The Macmillan Co., 60 Fifth Ave., New York. 1930.

This book introduces children to the common plants and animals. While it has all the advantages of a text, it reads more like a continuous narrative. At the end is a series of guiding questions. It contains many interesting photographs and thirty-eight original drawings. Grades 3–4. $3.32.

Patch, Edith M. *Holiday Hill.* The Macmillan Company, 60 Fifth Avenue, New York.

This will direct the attention of children to autumn berries, pine cones, trees, the squirrel and rabbit that could be met on an autumn walk. It is written with names for these as characters. It is well illustrated with photographs and drawings. Grades 3–5. $2.00.

Patch, Edith M. *Holiday Meadow.* The Macmillan Company, 60 Fifth Ave., New York.

This book begins with a brief account of *Holiday Meadow* itself and the animals and birds that live there. It is designed to stimulate an interest in insects and animal life of the meadow. Fully illustrated. Grades 4–6. $2.00.

Patch, Edith M. *Holiday Pond.* The Macmillan Company, 60 Fifth Avenue, New York. 1929.

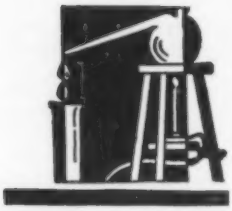
This volume is outstanding for the vividness with which it describes the plants and animals that may be seen about the pond at any time. It is attractively illustrated. Grades 3–5. $2.00.

Patterson, Alice Jean. *The Study of Nature.* Public School Publishing Co., Bloomington, Ill.

This book is a series of graded lesson plans which employ the seasonal arrangement of material and activities. The arrangement of the lesson plans correlates nature study with health. Grades 1–6. $0.90.

(*Continued in the October Issue*)

# Abstracts



## GENERAL EDUCATION

LANGE, EMIL. "Signs of Curriculum Progress in High Schools in California." *California Journal of Secondary Education* 10; October, 1934.

A questionnaire sent to 505 principals of secondary schools in California reveals these trends: "The broad fields and the unit-of-work curriculums are tending to displace the individual-subjects curriculum as the favored basic form of curriculum organization." "Variable subject matter is gaining favor at the expense of constant subject matter." "Emphasis upon attitudes and insights is being given primacy over emphasis upon knowledges and skills." "Laws of learning that give allegiance to interest, purpose, and functional need are displacing those which stress exercise and drill." "The principals have indicated that they are ready . . . to subordinate the teaching of the world *as it has been* to the teaching of the world *as it is* and *as it ought to be*." "The development of learning technics is given precedence over subject matter and its comprehension." "Although homogeneous grouping is generally employed, especially by the larger high schools, the criteria for sectioning are being re-evaluated, and the value of homogeneous groupings in an informal program is being questioned." "The findings show increasing provision in the larger schools for special coaching for slow pupils, for special classes for failing pupils, and for remedial classes." "Variation in pupil load is being increasingly employed." "An increasing tendency is shown to grant school credit for out-of-school projects or studies." "The counselor is increasingly regarded as the most important guidance functionary." "The schools are increasingly identifying themselves with the lives of the communities which they serve." The article further discusses the factors assisting and retarding reorganization and ends with recommendations. —F.D.C.

PROCTOR, WILLIAM MARTIN. "Trends in Pupil Guidance." *California Journal of Secondary Education* 10: 113–117; January, 1935.

This stimulating discussion deals with the following trends of American education: (1) the tendency of the junior high school away from serving as a terminal institution or as a medium of vocational education to functioning as an institution from which a large percentage of the pupils continue their schooling and in which "broadening and finding courses are the rule; (2) a tendency toward "decreased emphasis on vocational guidance in the junior high school" and toward "increased emphasis on such other phases of guidance as social, health, curricular, and recreational or avocational guidance. . . ."; (3) a trend in high-school education to relegate "the vocational courses to the eleventh and twelfth grades of the senior high school and to the junior college"; (4) a tendency due to "technological developments" in the industrial field toward (a) training in a related group of vocations rather than in a specific vocation, toward (b) "a closer tie-up between the vocational training departments of our senior-high schools and junior colleges and the world of business and industry; and toward (c) "re-guidance and retraining for those who have been displaced by technological developments; (5) "the trend toward the increase of training for leisure time activities for all classes of people; and (6) a trend toward an "increasing emphasis upon social engineering, as contrasted with economic and mechanical engineering." —F.D.C.

RHODE, ELLIS G., and ANDERSON, H. DEWEY. "The Tenure of High School Principals in California." *California Journal of Secondary Education* 10: 53–57; October, 1934.

The gist of this extensive and careful study is well summarized in the "conclusions": "There are decided difficulties confronting those who are intent upon entering the high-school principalship as a professional career. The oversupply of certified principals makes the chance of securing a position about one in thirty. Once in the profession there is little likelihood that the principal may remain in a single school for a long enough period of time to become a definite part of the economic and social community. This is particularly true if he is employed in a small high school. If the principal is forced out of the profession at any time his chances are relatively slight for getting back. He is more likely to secure work in teaching and remain there. A very small percentage of high school principals climb to higher administrative positions. A considerable percentage lose occupational, economic, and social status. The hazards of the service are too great to consider it a good occupational risk." —F.D.C.

Belden, Mabel and Eels, Walter Crosby. "The Improvement of College Teaching, The Lecture Method—Its Use and Abuse." *The Junior College Journal* 5: 183–189; January, 1935.

This stimulating article presents a careful analysis of the uses and abuses of the lecture method in college teaching. Following this analysis is a considerable number of quotations expressing the views of various authorities on aspects of the lecture method. The article closes with a page of questions intended chiefly to focus thoughtful attention upon the various points of view presented, and with an excellent bibliography. —F.D.C.

Bird, Grace V. "Junior College Problems in 1934–35." *The Junior College Journal* 5: 170–176; January, 1935.

This article is concerned with the development of two theses: "The junior college must furnish a response to this rising consciousness in the student of the things he needs or wants toward his self-realization, that will be satisfying to the student (the individual) and satisfactory to the state (the social group)." The article closes with a discussion of "social intelligence in the junior-college field." —F.D.C.

Littel, C. L. "The Junior College Movement." *The Junior College Journal* 5: 131–134; December, 1934.

After a brief discussion of the beginning of the junior-college movement, the author lists and discusses these reasons for "the growth and success of junior colleges in the United States": The junior college offers all work needed for four distinct types of students; the teaching in the junior college is often superior to that in four-year colleges; the classes in the junior college are smaller than those in universities; the junior college students have a smaller percentage of failure because the student adjustment is easier; "junior college transfers make good"; "the junior college is more economical to the student, the state, and the community"; "more students will attend college and thus secure proper advanced education if junior colleges are well placed"; "the social life of the junior college is good"; "extra-curricular activities in the junior college offer more opportunity for the individual because the student has to compete with only a small group, while in the large university he has thousands of competitors."

—F.D.C.

Caldwell, Otis W. "High School and Community—Questioning Certain Prevailing Practices." *School Science and Mathematics* 34: 933–941; December, 1934.

The keynote of this thought-provoking discussion is expressed by the author in his introduction, "I propose to question certain major prevailing, and presumably approved ideas and practices in public secondary schools. I propose also to make specific suggestions of ways in which some of these questioned practices may be improved." The author then discusses in considerable detail these four questions:

Can the high school render its best service by continuing to be so largely a school of languages? Has the program of studies of the high school, like its predecessor in the college, grown up as a series of separate subject interests? Are high schools really used as a means of growth in those qualities which we loosely call citizenship? Does the high school provide adequate and effective training in individual attitudes? —F.D.C.

Research Division of the National Education Association. *Modern Social and Educational Trends.* Research Bulletin, Volume 12, No. 5; November, 1934.

This is a most useful summary for every school man. The graphs tell the story as well as the text. Some of these graphs should be posted on the bulletin boards of every high school and college. Obviously, the material is pertinent to the problems of social studies classes.

There is contained a gold mine of material for science teachers to use in pointing out the implications of scientific applications in our present world. Every teacher should have a copy of this bulletin and read and use the contents.

—R.K.W.

Department of Secondary-School Principals of the National Education Association. *Tercentenary Celebration Contests, National Honor Society, and Directory.* Bulletin No. 54, January, 1935.

For all practical purposes devoted to a directory of the membership classified by states.

—R.K.W.

Department of Secondary School Principals of the National Education Association. *Tercentenary Celebration.* Bulletin No. 52, May, 1934.

This bulletin contains suggestions for community celebrations of the 300th anniversary of secondary education in the United States. A few suggestions for participation of science classes are found on page 11. On pages 20–21 is a brief bibliography of books dealing with the development of American secondary education.

—R.K.W.

Matthews, J. C., and Brenholtz, Harold. "Building Interest Guides for Junior Citizens." *Peabody Journal of Education* 12: 173–181; January, 1935.

Techniques to be used by the teacher in the construction of "interest guides" are suggested. A number of fertile suggestions are offered. One of the programs offers ideas for introducing

electricity to pupils. The material is stimulating but almost wholly unorganized from the point of view of the individual who is in any sense concerned with organization. The reader wonders what kind of an undigested ferment may be left with pupils as a result of the process.

Ten years ago this kind of thing would have worn the project label, but perhaps have had better organization in the usual sense of the term. —R.K.W.

BROADY, K. O., and MOOMEY, DEAN. "The Chester Six-Year High School." *The High School Teacher* 10: 294–295; December, 1934.

An experiment with the extension of curricular opportunities in a small high school through the medium of extension courses is described. The program of studies of the school and the additions made by means of extension courses are described. The correspondence courses are offered in cooperation with the University of Nebraska. The process used in supervising the work of the pupils carrying on the correspondence courses is described. —R.K.W.

WAPLES, DOUGLAS. "The Future Possibilities of the School Library." *The High School Teacher* 10: 267–268; November, 1934.

Bases predictions concerning the need for school libraries upon the current social trends and the actual readings of adolescents. The social trends are quoted from Professor W. F. Ogburn. These "will make good reading more necessary, they will increase the amount and variety of reading matter, and they will give more time for reading." The same trends threaten school revenues which might be used to extend reading opportunities.

School libraries and public libraries must combine funds and efforts and cease competitive expenditures in trying to meet problems of reading for young people.

The author states that the leisure reading problem is the most important problem that we face. Throws doubt upon the possibility of interesting everyone or even the majority in a wide range of profitable reading. —R.K.W.

WRIGHT, CLAUDE F. "New Grades for Old." *The High School Teacher* 11:27; January, 1935.

An alliterative characterization of the pupils meriting the usual letter marks of A, B, C, D, and F. The characterizations are very cleverly done. The book is worth thoughtful perusal by any teacher. —R.K.W.

DEWEY, JOHN. "Can Education Share in Social Reconstruction?" *The Social Frontier* 1:11–12; October, 1934.

In the opinion of the author the schools should and must share in social reconstruction, but in no literal sense can they be the builders of a new social order. —C.M.P.

Symposium: Indoctrination: The Task Before the American School? *The Social Frontier* 1:8–33; January, 1935.

There are discussions by Lawrence Dennis, F. J. Sheed, Earl Browder, Harry D. Gideonse, George A. Coe, Boyd H. Bode, and the Editors of *The Social Frontier*. As might be expected in the discussion of so controversial an educational issue, there is no unanimity of opinion. As the editors point out, *The Social Frontier* is "not merely a journal of educational discussion, an organ for assembling of diverse ideas and opinions; it is a journal of educational criticism and reconstruction; it is an instrument for positive fashioning of programs and philosophies." This function is characteristically maintained in this discussion, as it has been in all preceding issues involving many controversial educational, economic and social problems. —C.M.P.

FAIRCHILD, HENRY PRATT. "A Sociologist Views the New Deal." *The Social Frontier* 1:15–18; October, 1934.

The author discusses the following theses: (1) The end of an era; (2) Tasks before the New Deal; (3) Political liberalism linked with economic conservatism; (4) Prices versus wages; (5) Taxation versus loans; (6) Theory of scarcity versus fact of abundance; (7) The tragic lack of a reconstructive social philosophy; and (8) A new deal or a new deck. —C.M.P.

MCCALL, WILLIAM A. "My Philosophy of Life and Education." *Teachers College Record* 36:409-418; February, 1935.

This very sane and most interesting article deals with the psychology of purposes. The following theses are discussed: (1) If all learning is bond-forming, then bonds are binary rather than unitary, for purposes and abilities are psychologically distinct; (2) When properly conceived, there is a complete identity between the fundamentals of philosophy, psychology, and education; (3) The philosophical ultimate operates unceasingly from the cradle to the grave; (4) Only purpose begets purpose; (5) Only purpose makes purpose permanent; (6) Purposes are not made permanent by exercise; and (7) The fundamental psychology of learning is very simple despite its apparent complexity. —C.M.P.

WOODRING, MAXIE N. and FLEMMING, CECILE WHITE. "A Third Bibliography on Study." *Teachers College Record* 36:397–408; February, 1935.

This third bibliography covers the period of 1932-1934. During the period of 1917-1928 major interest and emphasis seems to have been upon administrative plans and schemes for supervised study, general directions on how to study and investigations through questionnaires and interviews of how high-school and college students thought they studied. The period covered by

the second bibliography, 1928-1932, saw the introduction of "how to study courses" in high school and college. The present bibliography shows marked attention to the use of the library as an integral part of the study program and the use of library guides and workbooks.

—C.M.P.

Briggs, Thomas H. "What the Emotions Do To Our Thinking." *Teachers College Record* 36: 372-379; February, 1935.

This is a rather timely article on the part the emotions play in our thinking. As teachers and educators we have been too prone to underemphasize the importance of the emotions as they relate to the thinking process. —C.M.P.

## SCIENCE IN EDUCATION—GENERAL

Caldwell, Otis W. "Work of the Committee on the Place of Science in Education." *School and Society* 40: 673-679; November 24, 1934.

This article traces the work of the Committee on the Place of Science of the A.A.A.S. from the time of its establishment in 1923 to the announcement of the program for the Pittsburgh meeting, December 29, 1934.

The activities of the Committee from the beginning have been directed toward making science understandable to the layman and stimulating interest in science in the schools as well. These activities have consisted of public programs of addresses by eminent scientists held at the time of the annual meeting; the preparation of a bibliography related to the use of science in schools; a pamphlet outlining "current thought regarding certain phases of purposes of science education"; plans for organizing a Bureau for the coordination of activities in science education; extending aid in research studies in science teaching; sponsoring a national high-school science essay contest; *etcetera*. Its avowed purpose in encouragement toward the active search for truth, which is, of course, the aim of science itself. —A.W.H.

Rogers, Herbert W. Science in Secondary School and College. *School and Society* 40: 334-336; September 8, 1934.

"This article is concerned with some relationships existing between grades achieved by college students in the various elementary science courses in college." The data are apparently from students in Lafayette College, although this is not definitely stated. Correlations of intelligence and grades in chemistry, physics, and biology; and correlations of academic standing for four years and grades in college chemistry and physics were computed. Grades in secondary school sciences are also compared with intelligence ratings and with grades in college.

Among the conclusions are the following: Grades in science are found to be a function of intelligence but for chemistry and physics are not closely related to academic standing. There seems no tendency for those of higher intelligence to take high-school sciences. Science students in high school make higher grades in college science. —A.W.H.

Lee, Ben S. "Science's Contribution to Citizenship." *The High School Teacher* 10: 28-29; November, 1934.

A general statement concerning the contributions of the natural sciences to current life. The author says the article is an attempt to show that science is a potent influence in developing good citizens. —R.K.W.

Obourn, Ellsworth S. "Teaching Scientific Method—The Scientific Method in the Classroom." *School Science and Mathematics* 34: 969-972; December, 1934.

This article, the seventh in the series on "Teaching Scientific Method," presents a detailed and stimulating discussion of scientific method which it follows with an illustration of ways in which scientific method may be taught with nine demonstrations appropriate in the development of a thorough comprehension of the kinetic molecular concept. —F.D.C.

Watkins, Ralph K. "An Analysis of the Types of Scientific Methods Used by the Layman in Typical Out-of-School Situations." *School Science and Mathematics* 34: 804-810; November, 1934.

The writer and his seminar group contributed from their experience and observation out-of-school problems typical of those met in everyday life. They classified these under eight appropriate headings which they further analyzed in order to obtain a list of the kinds of experimental attack which are most often used in solving such problems. As the final step in the study they determined a list of "trainings which must be undertaken in order to enable citizens to be able to apply scientific methods." —F.D.C.

Gosling, Thomas W. "Science and Opinion." *School Science and Mathematics* 34: 913-918; December, 1934.

The author urges a constructive teaching program by which pupils are given effective training in the use of the scientific method. He states the two "functions which the schools can perform in making the scientific method the basis of public opinion" to be these (1) ". . . through the use of the proper materials and techniques of teaching," to "provide a broad base of general intelligence

among the people—an intelligence that is alert, honest, and fearless," and (2) "to increase the number of those who are able to provide intellectual leadership and who are willing to use the method of science in attaining their ends."
—F.D.C.

## SCIENCE IN THE ELEMENTARY SCHOOL

DAVIS, IRA C. "A Teacher's Approach to the Problems in Teaching Elementary Science." *School Science and Mathematics* 34:275–383; March, 1934.

Following an interesting development of the history of elementary science, the author describes the programs now in progress by the Wisconsin State Science Committee of which he is Chairman. This program consists essentially of three steps: (1) to develop a practicable and understanding philosophy of science teaching; (2) to select and organize the subject matter in harmony with this philosophy, determining the content chiefly from analyses of the activities and experiences of children; and (3) to perfect one's own methods of teaching science. —F.D.C.

CHRISTINA, SISTER M. "Snow." *The Grade Teacher* 52:31; 73–74; January, 1935.

This is a lesson in elementary science intended for the primary grades. —C.M.P.

WYNNE, MARION T. "The Eskimos." *The Grade Teacher* 52:34–35; 54–55; January, 1935.

This is an excellent illustrated unit describing the life and activities of the Eskimos. The unit contains a considerable amount of science.
—C.M.P.

KNOWLES, LOIS. "Were You On Time Today?" *The Grade Teacher* 52:38; 62–63; February, 1935.

This is an illustrated elementary science unit on methods of keeping time, both ancient and modern. —C.M.P.

STILLMAN, ALBERT E. "The Roadrunner." *The Grade Teacher* 52:40; 60–61; February, 1935.

An intermediate grade unit by a western naturalist on the western roadrunner, one of the most interesting of our birds. Illustrated.
—C.M.P.

CLAYTON, MARGIE. "The Weather." *The Grade Teacher* 52:36; 62–63; March, 1935.

This is an illustrated third-grade unit presenting activities for the unit and indicating how the unit may be correlated with the other school studies. —C.M.P.

EMANUEL, BESSIE B. "A Unit of Study—Sea Food." *The Instructor* 44:16; 62–63; March, 1935.

This first-grade unit contains much elementary science material with suggested activities and a bibliography. —C.M.P.

## SCIENCE IN THE HIGH SCHOOL

BARNETT, JOHN A. "Teaching General Science." *The High School Teacher* 10:293–320; December, 1934.

This might be characterized as an attempt at a platform for a general-science teacher. Three principles are suggested as basic: "First, nothing can be learned in which the learner is not interested; second, nothing can be learned in which the learner does not see a sense of worthwhileness; (third?) the learner always proceeds from the known to the nearest related unknown." Some present-day psychologists will certainly question this set of "principles" as axiomatic.

General science is pictured as spreading into grades seven, eight, and nine of the junior high school. The sequence of content recommended is that of plants and animals in seven, health in eight, and man's control of environment in nine. No justification nor supporting data are offered to support this proposed sequence.

The shades of the "Cardinal Principles" are called to witness along with the disciplines of accuracy, intelligent thinking, and open-mindedness as justifying the teaching of general science.
—R.K.W.

SCHELLHAMMER, FRED M. "The Field Trip in Biology." *School Science and Mathematics* 35:170–173; February, 1935.

This is the report of a controlled learning study in which the experimental groups were given a one-period field trip in addition to the same amount of time spent on the study of the unit as that afforded the control group. The groups were then rotated for the second unit. The statistical results support these conclusions of the experimenter: (1) "the field trip was successful as a device for increasing the learning process as measured in terms of pupil ratings"; and (2) "the results scored in the two experiments show an increased average rating per pupil when the group was used as an experimental group." —F.D.C.

NUTTING, J. MORLEY. "The Mimeoscope in Science Teaching." *School Science and Mathematics*" 34:714–719; October, 1934.

This article is devoted to a discussion of the problem of constructing work exercises and test sheets at home, which present to the pupil concrete situations capable of objective teaching and

testing. Complete illustrations are given of types of exercises concerned with "the processes of recognition, total recall and association of many facts and situations in one concrete problem diagram." —F.D.C.

Roseman, R., Allen, B. W. and London, L. P. "You May Not Know." *Journal of Chemical Education* 12:88; February, 1935.

A new page in this journal which should be continued because of its interest to teachers of chemistry as well as other sciences. In this first page are pictures of St. Albert the Great and St. Thomas Aquinas, and a statement regarding the former who was made the Universal Doctor because of the breadth of his knowledge. —V.H.N.

Whitton, Emma. "Science in South Carolina High Schools." *Journal of Chemical Education* 11:578–579; October, 1934.

A study is reported here of the status of science instruction in accredited high schools and those known to offer science courses, in the state of South Carolina. Almost all these schools offer general science and biology, and about two-thirds offer chemistry and physics respectively. Most teachers of these courses have a bachelor's degree. For the state as a whole, only about 20% of high-school students have an opportunity to study any science other than agriculture. —V.H.N.

Hendricks, B. C., Tyler, R. W. and Frutchey, F. P. "Testing Ability to Apply Chemical Principles." *Journal of Chemical Education* 11:611–613; November, 1934.

Two methods of applying chemical principles are defined. In one case it means the ability to explain the result of a chemical reaction, the reaction and the result being given. The second definition involves predicting the result of a chemical reaction, and explaining it. The authors describe tests which have been devised to measure both types of ability. These tests are objective, and give correlations above .80 with tests which are presumed to measure the same abilities but which are not objective. —V.H.N.

Fliedner, Leonard J. "A Chemistry Project in Photography." *Journal of Chemical Education* 11:620–622; November, 1934.

Five members of a high-school chemistry club selected for its project the developing and printing of pictures. This grew into an organization known as the Camera Club which took many excellent pictures. The members learned to develop films and make prints and also made some money for the club by selling views of the high-school building. —V.H.N.

Powell, Orbun V. "Chemistry Assembly Programs." *Journal of Chemical Education* 11:551–554; October, 1934.

This article contains many valuable suggestions for the person in charge of assembly programs in the secondary school, whether the program is to be a science program or of some other nature. The objectives and educational principles involved are first discussed. Then several types of chemistry programs and methods for presenting them are suggested. A good bibliography completes the article. —V.H.N.

Bateman, George M. "Trends in Science Teaching." *Journal of Chemical Education* 11:540–542; October, 1934.

The author brings out some of the promising trends as well as some of the existing weaknesses in present-day science teaching. In the first category are cited efforts to break down formal divisions between the subject matter of the various sciences, and the increased use of visual aids. Among the outstanding weaknesses pointed out is the failure of science teachers to realize that their chief job is to teach students rather than a logically organized body of knowledge. Teachers should know their subjects but they should teach science with an aim to the inculcation of the principles of the scientific method rather than for retention of facts unrelated to the lives of their students. —V.H.N.

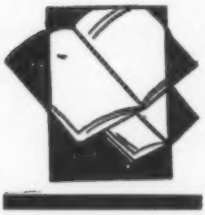
Lincoln, A. T. "A Chemical Exhibition." *Journal of Chemical Education* 11:659–660; December, 1934.

A description of a variety of exhibits prepared by the staff of a college chemistry department with the aid of several hundred students. No stunts or mystifying demonstrations were employed but displays of various types of chemical work and products as developed in the college and in industry were featured. V.H.N.

Fitzpatrick, Frederick L. "Biology Courses for General Science and General Biology Teachers." *Teachers College Record* 36:292–302; January, 1935.

As the author points out, many biology teachers are inadequately trained in the subject matter of biology itself (and probably other phases of teaching, too). The author suggests, as probably best for meeting the needs of most general biology teachers and general science teachers, a course in each of the following: general biology, general botany, general zoology, genetics and eugenics, economic biology, general physiology, microbiology and ecology. —C.M.P.

# New publications



ROBBINS, WILFRED W. and PEARSON, HELEN M. *Sex in the Plant World.* New York. D. Appleton-Century Company, 1933. 193 p. $2.00.

This book presents an interesting discussion of sex in plants. The discussion proceeds from the more obvious manifestations of sex in flowers to those forms of plant life in which sex life is not so apparent to the untrained student. There are also discussions of a sexual reroduction, parthenogenesis, sterility and inheritance in plants. The book is replete with diagrams and pictures and is written in a style intended to make it understandable and interesting to the layman.

In attempting to popularize the work, the authors may be criticized for trying too hard at times, and in so doing, for using a phraseology which smacks too much of purpose. Such chapter titles as "Plant Courtships" and "How Plants Prevent Inbreeding" are examples, even though in the first instance the authors hasten to deny the obvious implication. On the whole the book will probably be of interest to educated laymen as well as to others with more training in science.

—V.H.N.

DE LEEUW, A. L. *Rambling Through Science.* New York: McGraw-Hill Book Company, 1932. 320 p. $2.50.

As the title suggests, this book is a series of rambles into the field of science. These rambles are in a certain sense restricted as to territory. They are confined largely to the field of physics and particularly to discussions of the nature of matter, which, of course, carries the author also into the fields of chemistry and astronomy. The theory relativity and the fourth dimension, atomic structure, radioactivity, the energy concept, and the quantum theory, form the nuclei for the major portions of the presentation.

The aim is to discuss these matters in terms that the intelligent layman can understand. The author is particularly happy in his use of illustrative material from everyday life. The style is charming and the touches of humor add not a little to the readability. A subject that is not easily comprehended, even by the average trained scientist, is discussed in a manner that will make many ideas meaningful which would otherwise be largely technicalities to the person untrained in science. The book is a valuable contribution in its field. It is not one that the average high-school student or graduate will read with much interest but is pitched rather to the level of the college graduate who may have some desire to know more about what modern physical science is working at.

—V.H.N.

WEIDLEIN, EDWARD R. and HAMOR, WILLIAM A. *Science in Action.* New York: McGraw-Hill Book Company, 1931. 310 pp. $3.00.

This is a book written in readable and interesting style, showing what industrial research is, what institutions are carrying it on in this country, and what is being accomplished through the work done. Included are discussions of the present and past conditions in industrial research, the relation of science, invention, and research to human welfare, science in the industries, science as the pilot of technology, scientific management, and industrial research methods and men. The authors are men who know the field, and the picture they give shows how much indebted we are to the spirit of science and research here exemplified. The book should be especially useful to those who wish to explore the vocational fields related to science and invention. Almost every phase of life receives attenion, including the necessities in air, water, food; advances in medicine, agriculture, eradication of plant and animal pests, new chemical materials heretofore unknown, oil, lighting, x-rays, communication by telephone, telegraph, and radio, aviation, steels, fuels, refrigeration, waste reduction, rubber, textiles, and so on.

—A.W.H.

POLAKOV, WALTER N. *The Power Age.* New York: Covici: Friede, 1933. 248 p. $2.00.

The machine age is dead; the power age is here. Present methods of power production are not an extension of but a wholesale scrapping of machine age techniques and machine age economics. Our disease is not technological unemployment, but rather the unemployement of technology. So runs the main theme of this excellent treatise on the economic conseqneces of science to society.

Mr. Polakov is by profession, an industrial engineer. In this book, he utilizes the techniques employed in engineering science in marshalling his facts, analyzing his data and stating his conclusions. The statistics are pertinent and con-

clusive, yet not so voluminous as to detract the reader's attention away from the solution of the problem at hand. The charts and graphs, although few in number, greatly enhance the significance of the data presented. As the author points out time and again—things cannot go on as they are or as they have been. There can be no going back to the "good old days" of cut-throat competition and economic inefficiency. As he puts it, by "using existing technology and managerial means—instead of 25,000,000 workers ordinarily employed, we could satisfy all the demand for goods that existed in 1929 with only 625,000 workers." If we are to solve our problems, more science rather than less is absolutely essential. Thus, the present power age is distinguished from the past machine age "not merely by the magnitude and speed of production but by new characteristics which make it different in kind from any preceding era." —C.M.P.

Shimer, Hervey Woodburn. *An Introduction to the Study of Fossils.* (Plants and Animals.) New York: The Macmillan Company, 1933. 467 p. $4.00.

The first chapter presents a very simple yet adequate treatment of the factors involved in fossilization and of what fossils tell about earth history. A thorough treatment of plant and animal classification then follows. Even though this is more of a reference manual than a textbook in form, and with the material arranged according to the formal system of classification, it is almost as readable and as interesting as would be a semi-popular treatise on the subject. It packs into one volume a very comprehensive overview of plant and animal life. Living forms are first discussed with especial reference to those features which will help the student to understand the related fossil forms. The response which these living organisms make to their environment is considered, where they live, how life is maintained and how they reproduce.

This book should prove a useful reference to any teacher of biology or geology. The illustrations are many and excellent. Many key words and phrases are accentuated by being printed in black type, which aids in quickly locating information which is sought. —O. E. Underhill.

Ridgley, Douglas C., Forsythe, Marion B. and Koeppe, Clarence E. *South America and Eastern Hemisphere.* Bloomington, Illinois: McKnight and McKnight. 1932. 128 p. $0.48.

This is a reference workbook designed to accompany any textbook in geography. All continents are included except North America. The workbook presents a considerable amount of information and many suggestion not usually found in textbooks. There are provisions for map exercises of various kinds, for picture study, for various collections and tabulation of facts, for games, tests, exercises and both basic and supplementary references. It is recommended as an excellent tool for geography teachers. —C.M.P.

*United States Government Publications of Use to Teachers of Geography.* Circular Number 28. United States Department of the Interior. Office of Education. Washington, D. C., 1932. 15 p.

This circular lists more than three hundred government publications useful to teachers of geography. —C.M.P.

Washburne, Carleton and Washburne, Heluiz, in collaboration with Reed, Frederick. *The Story of Earth and Sky.* New York: D. Appleton-Century Company, 1933. 368 p. $3.50.

This book is a splendid illustration of the kind of book needed for reference by boys and girls of elementary and intermediate grades. Part I, The Story of the Earth, is designed to show how the earth was probably formed; Part II, Neighbors in the Sky, describes an imaginary trip to the moon with stops at Mercury and Venus, and a narrow escape from collision with the moon, a ball game played on the moon, a trip to Mars, and other discussions to round out the topic relating to our heavenly neighbors; Part II, The Stars, tells about the great constellations, with stories of how they were named, and how they are used in our determinations of time in the large; Part IV, How We Found Out These Things, gives an account of our accumulations of knowledge from early Grecian times and shows what science is now attempting to explain.

The style is interesting and stimulating and will undoubtedly appeal to many school pupils. Not only is the information about our physical world made attractive but the appreciations of the problems of the scientist and the attitudes which their solution demands are made to stand out clearly. The books must be considered unusual. It should be found in every school library. —A.W.H.

Bailey, H. L. *How Plants Get Their Names.* New York: The Macmillan Company, 1933. 209 p. $2.25.

The first chapter discusses in a most interesting manner why two similar plants have the names that they do and why these names have been changed occasionally. The second chapter deals with the development of the Linnaen system of classification. The third chapter deals with the identification of plants and the need for accurate knowledge of structure before the correct name can be determined. Chapter four gives the rules of nomenclature. These rules are applied to various cultivated plants by way of illustration. The last chapter of some eighty-odd pages gives ten pages to a discussion of pronunciation and the use of Latin names, and two lists, one of the generic names likely to be met with in horticul-

tural literature, with indication of accent and vowel quality, and the second, a list of the specific Latin names, with guide to pronounciation and suggestion of the botanical meaning. This book makes much more interesting reading than the brief listing of chapter contents above would indicate. The style is extremely readable.

—O. E. Underhill.

COMSTOCK, J. H., COMSTOCK, A. B. and HERRICK, G. W. *A Manual for the Study of Insects.* Ithaca, New York: The Comstock Publishing Company. 1931. 384 p. $2.20.

This posthumous twentieth edition of the well-known Comstocks, revived by Professor Herrick, who was a student at Cornell when Professor Comstock brought out the first edition in 1895, has been brought up to date and somewhat simplified with the intention of making it suitable for beginners in entomology. It presents its usual wealth of information. The first chapter discusses briefly the classes under the phylum arthropoda, and the second chapter with insects as a class. The remaining chapters discuss the various orders of insects. A table for determining the family to which a given species under examination may belong is given for each of the more important orders. This book could well be in every school reference library. —O. E. Underhill.

PEABODY, J. E. and HUNT, A. E. *Biology and Human Welfare.* New York: The Macmillian Company. 1933. 640 p. $1.60.

Teachers of biology seem rather more ready than those of the other special sciences to modify their textbooks in the line of the more recent developments in the field of pedagogy. This text is one of three or four published in the last year or two which attempt to find some more functional form of organization than that of the traditional high-school biology course.

Especial attention has been given to the consideration of applications of the subject to human welfare. The first unit attempts to arouse interest by giving a preview of biology and its significance, and to give some understanding of the methods of acquiring knowledge in this field used by scientists. Each unit is subdivided into workable portions of subject-matter which are called "problems." The reviewer is glad to see that the author and publisher did not feel it necessary to head numerous sections with rhetorical questions in order to be in style. Where a simple statement seems more desirable than a question it has not been felt necessary to turn it around into the question form. On the other hand questions are used freely where they suggest real problems for further study. Perhaps the next step will be to set up criteria so that the term "problem" may be reserved for real problem situations set for the pupil to work through, rather than for more or less comprehensive questions the answer to which is to be arrived at through study of the matter which follows.

This appears to be a very interesting, well-organized and teachable text. A list of reference books is given and there are several pages of suggestions for teachers. —O. E. Underhill.

BRUCE, GEORGE H. *High School Chemistry.* Yonkers-on-the Hudson: World Book Company, 1933. 550 p. $1.60.

In the revised edition of this book, as stated by the author in his preface, "Certain paragraphs have been redrafted to make for greater clarity and simplification, and certain new material has been incorporated to bring the subject matter up to date." A careful perusal and page by page comparison of the old and the revised editions lead to the conclusion that the revision is not a fundamental one. The greatest changes have been made in the chapter on valence, which has been partially rewritten, and in the chapter on atomic structure, where new diagrams have been introduced. On the whole, teachers who are using the first edition will probably have little inclination to discard it for the revised one. —V.H.N.

SLAVSON, S. R., and SPEER, ROBERT K. *Science in the New Education.* New York: Prentice-Hall, Inc., 1934. 396 p. $2.50.

Primarily, this is a plea for the use of the search-discovery method in the teaching of science. Chapters I and II on "Trends and History" are introductory. Chapters III–VII deal critically with studies of children's interests in science materials; the discussion is the best available. Chapters VIII–X are on objectives; Chapters XI–XII are an excellent review of current methods. The remaining three chapters are on the search-discovery method. The nature of this method is indicated by the following quotations.

"But mainly he (the teacher) was there, he explained, as a convenience, only occasionally as a necessity. The materials and apparatus were within easy reach of the children. They could come and use them as they pleased. They could feel their way about, get acquainted gradually with Bunsen burners, test tubes, batteries, magnets, little engines, small dynamos, bells, carbons, voltmeters, lenses, rubber tubing, glass tubing, scales, charts, and reference books on science. A boy might begin in the spirit of play to heat glass tubing and find that it could be readily turned into various shapes. He might go from that to try to make thermometers, or as did one twelve year old boy, to etching glass, a process that required weeks of research" (p. 322).

"We have found that if the child is permitted active experience with scientific phenomena; if he can repeat his experimentation; if he can draw conclusions in his own play forms, he will

inevitably and unconsciously discover the methodology of science. It seems to us that a large objective of science teaching is *the discovery of the method of science.* Contacts within the school should aid pupils to discover for themselves the characteristics of reasoning and thinking that make science a unique body of knowledge" (p. 189).

The search-discovery method utilizes all other methods. It is not omnipotent. It dominates child learning in inverse progression to the child's age. —E.R.D.

Emerson, Haven, M.D. *Alcohol, Its Effects on Man.* New York: D. Appleton-Century Company, 1934. 114 p. $1.00.

This book is not propaganda; it is a scientific treatise. Its statements are based on the findings of commissions of scientific experts appointed to study the subject in Great Britain, Germany, Holland, Sweden and the United States. Their reports are cited in the bibliography.

Alcohol is not a stimulant, it is an anæsthetic. It exerts a depressant effect on the nervous system. It is largely oxidized in the body but "can not be used in transformations of energy or in the performance of muscular work." It lessens the speed of voluntary and reflex muscular activity from five to sixty per cent when used in moderation. It dulls the eye, ear and touch and reduces the accuracy of coordination. "It impairs reason, will, self-control, judgment, physical skill and endurance." It is "not a digestant, a gastric tonic or a stimulant to digestion." On the contrary it retards digestion. Persistent excessive use "reduces fecundity and increases the probability of still births and the production of defective young." It decreases resistance to respiratory infections and septic infections after accident or operation. It produces mental disease. It is a major cause of infections of syphilis and gonorrhoea. "It is a constant and essential stock in trade for the promotion of prostitution." Taking the death rate, Northwestern Mutual Life Insurance Co., 1885–1924, as 100 for total abstainers, that of moderate users was 111, of regular beer drinkers was 139, of spirit drinkers was 181.

The book should be read by every pupil before he is through the grades and by every pupil's mother and father. Here is a fine chance to see in how far individual and national behavior will be influenced by a forceful recital of facts.

—E.R.D.

Thomas, Margaret Loring. *Paulo in the Chilean Desert.* Indianapolis: The Bobbs-Merrill Company, 1934. 190 p. $2.00.

Life in the Chilean Desert with its ever present water problem would seem odd and strange to an American boy whose education and surroundings are so different. What a strange yet practical and effective education did Paulo receive. An interesting book for junior-high-school boys because of the contrasts is portrays in the opportunities of boys in Chili as compared to America. —C.M.P.

Scoyen, Eivind T., and Taylor, Frank J. *The Rainbow Canyons.* Stanford University: Stanford University Press, 1931. 105 p.

This delightful little book describes and relates interesting stories about the rainbow canyons of Southern Utah, of which Zion and Bryce National Parks are the better known. These stories relate not only to the stories of ancient life written in stone, but also to the records of prehistoric man and the history of the early American Indian. As the authors describe them "The Rainbow Canyons are sculptured on a magnificent scale through layers and layers of colored sand-stones, reds, lavenders, grays, pinks, whites and even golden tones. The rains of Time have trickled down the canyon walls, blending the hues, until their only rivals are the spectra of the sky-born rainbows." —C.M.P.

Seton, Grace Thompson. *Magic Waters.* New York: E. P. Dutton and Company, Inc., 1933. 281 p. $3.75.

This is an interesting narrative of the adventures of the author (wife of the famous naturalist, Ernest Thompson Seton) through South American jungles and mountains never before explored by a white woman. With only native guides, she navigated dangerous rivers, cut her way through the jungles and traversed perilous mountain defiles. Her descriptions of the fauna and flora of the regions traversed, and of the thrills in collecting fauna museum specimens, make it a book interesting to read both from the standpoint of the scientist and from that of a traveller along strange and unfamiliar byways. Readers will agree that the author is an excellent explorer and a most skillful hunter.

—C.M.P.

Kellogg, W. N., and Kellogg, L. A. *The Ape and the Child.* New York: McGraw Hill Book Company, Inc., 1933. 341 p. $3.00.

Occasionally there appears a book reporting a piece of research which is daring in its conception, thoroughly scientific in its method, and full of human interest, all at the same time. This is such a book. It reports one of the most interesting and significant experiments which has appeared in recent years.

The experimenters borrowed for their purposes a seven and one-half months old female chimpanzee which, up to the time of beginning the experiment, had been reared in captivity in the normal way with its mother. This small ape was taken by the Kelloggs into their family and for nine months was treated exactly like their own child who was two and one-half months

older than the ape. The ape, Gua, and the child, Donald, lived together, played and ate together, and were treated exactly alike as nearly as was humanly possible for nine months. Their equipment as regards clothing, playthings, beds, *etcetera*, and their daily routine of feeding, naps, and bathing were as similar as it was practical to make them. The experimenters seemingly both devoted full time to the care and observation of the two infants. Careful tests, observations and measurements were made of both subjects constantly. These included records of physical growth, health, eating and sleeping; physiological, social, emotional and mental behavior and development; development of motor and learning ability, and language. Direct comparisons in all respects were systematically made between the human child and the ape.

The data presented in the report are too detailed and comprehensive to permit of adequate review here. Suffice it to say that the results leave a serious doubt as to any general superiority of either subject. Where, on the one hand, the child showed superiority in certain types of behavior, the ape was distinctly the better in other respects. At the close of the experiment when Donald was about nineteen months old and Gua about sixteen, they were still remarkably alike with respect to the stage of development attained.

As the experimenters themselves point out, it is interesting to speculate on how long the equality between the subjects might have persisted or even how long it could have been maintained if the experiment had been continued indefinitely. Undoubtedly language handicaps would produce an ever-increasing disparity. Physiological and social handicaps would also certainly become more and more important as the contacts of the subjects reached beyond their own small and more or less artificial world. Nevertheless, the fact that the ape could keep up with, and in some respects even exceed, the child both in motor and in intellectual abilities would seem of great significance.

The report is well written and is singularly free of technical "jargon." The intelligent lay reader will find little that occasions difficulty. The use of metric units in reporting measurements might perhaps have been dispensed with unless their equivalents in English units had consistently been given which was not the case. The use of the editorial "we" and the third person throughout tends, at times, to become slightly burdensome. On the technical side, it might have been slightly more accurate to give results of tests in terms of equivalent ages (especially in the Gesell series) rather than as though the two subjects were of the same age. The authors are to be commended on their detached and impersonal presentation of data and the impartial scientific spirit which characterizes the entire report. Not all parents could have conducted the experiment involving their own child with such a thoroughly scientific attitude.

—V.H.N.

PATCH, EDITH M., and HOWE, HARRISON E. *Science at Home.* New York: The Macmillan Company, 1934. 450 p. $0.92.

This book tells about homes, materials used in building homes, as well as things in and around the home; about the flowers and the garden guests; of the homes of man and of insects; of water and electricity in the home, and the work of the plumber and electrician; how homes are heated and clothing keeps us warm; how cleaning is done, and a chapter on the foods we eat.

It is in the nature of a science reader, but each chapter ends with thought provoking questions and suggestions for pupil activities. The print is large, the illustrations are excellent, and the cover is attractive. It is a book to hold the interest of the boy and girl of about the fifth- and sixth-grade levels. —W.G.W.

WEBSTER, HANSON H. *The World's Messengers.* Boston: Houghton Mifflin Company, 1934. 342 p. $1.04.

This is a fine companion volume to the author's *Travel by Air, Land, and Sea.* It begins with familiar means of communication, follows them back to their origin and then goes on to explain their value in the world today. The science involved is simple, but adequate for the purpose.

There is need of a book like this as a supplementary reader in elementary science. It is adapted for a young scientist to get information that he can bring to the class and interest them in his story. Of course, it is just as valuable to supplement social subjects too. It treats written and spoken words, signals, radio, telephone, telegraph, newspapers, and the mail. It is illustrated by nine full-page half-tones and many drawings. —W.G.W.

*American Association for the Advancement of Science. Summarized Proceedings,* June, 1929–January, 1934, and Directory of Members. Published by the Society, Washington, D. C. 1245 p. $4.50.

The summarization of proceedings gives membership data, constitution and by-laws, background and origin of the association and lists of meetings with their place, date and titles of papers read. This whole summary comprises but 187 of the 1245 pages, the main portion of the report being the directory of members. The alphabetical list gives address and major field of interest. The names are also grouped according to the city or town of residence.

—O. E. Underhill

# News and announcements

## MINUTES OF THE EIGHTH ANNUAL MEETING OF THE NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

Atlantic City, New Jersey, February 24, 25, 26, 1935
Headquarters: Hotel Chelsea

The dinner meeting was held on Sunday evening, February 24, at six-thirty o'clock.

The meeting was called to order by the President, Archer W. Hurd. The first item of business was the report of the Secretary-Treasurer, S. Ralph Powers. The reading of the minutes of the meeting in Cleveland was dispensed with for the reason that they had been distributed to the members by mail. The report of the Secretary-Treasurer was read and approved. A copy of the Treasurer's report is appended.

The next item of business was the reports of committees.

1. The report of the Committee Cooperating with the A. A. A. S. Committee on the Place of Science in Education. This report was presented by Harry A. Carpenter, Chairman. In his report Mr. Carpenter told of the formation, at the meeting in Pittsburgh of the A. A. A. S., of an organization called the American Science Teachers Association. He explained the function of this new organization and the relationship of N. A. R. S. T. to it. This report was accepted and the committee continued.
2. The Committee on Publications and the Committee on the Special Yearbook. No report. Chairman absent.
3. The report of the Committee Appointed to Study Eligibility for Membership. This report was presented by Gerald S. Craig, Chairman. The report was circulated in mimeographed form. It was accepted, to be referred to a Committee on Constitutional Revision. The Committee on Eligibility for Membership was discharged.
4. The report of the Committee on Tenure and Rotation of Office. The report, prepared by the Committee, was read by Victor H. Noll. The report was accepted and the committee continued. At the request of the committee for an addition of two members, the President appointed W. L. Eikenberry and Homer W. LeSourd as additional members of this committee.
5. The Report of the Executive Committee. This report was included in the minutes of the meeting in Cleveland and was accepted without further discussion.
6. The report of the Program Committee. This report was presented by Morris Meister, Chairman. The report follows:

   "As this was the first time the arrangements for the entire program were entrusted to a Program Committee, it may be of interest to the membership to note some of the experiences of the committee in fulfilling its function.

   (a) It proved very difficult to discuss plans by mail. The committee should not be too widespread geographically.
   (b) The committee did not fully understand its relationship to the Executive Committee in assuming responsibility for the program. The chairman recommends that the Executive Committee assume responsibility for policy and that single programs or parts of programs be turned over to the Program Committee.
   (c) The committee was not quite certain as to the desirability of inviting "outside" speakers. This matter should be decided by the membership at an early date.
   (d) In view of the report of Dr. Webb's committee and of our experiences in arranging the 1935 program, the committee urges that no complicated procedure for program-making be adopted by the N. A. R. S. T.

   The committee wishes to thank Dr. Hurd and Dr. Powers for their assistance."

   This report was accepted and the committee discharged.
7. The report of the Board of Experimentation. This report was made by Archer W. Hurd, Chairman. The report follows:

   "After the last annual meeting of the Association at Cleveland, the Board of Experi-

mentation, consisting of fifteen members located in strategic experimental centers, was formed with the approval of the Executive Committee. A plan of experimentation was drawn up, based upon the findings of the research conducted the preceding year by the Committee on Criteria for Selecting Subject Matter for Science Instruction. This plan was submitted to members of the Board of Experimentation and revised according to the consensus of the suggestions offered. The plan included a request to the General Education Board for a fund of approximately $100,000 to finance the proposed experimental program. Distribution of the funds among the various experimental centers and a central organization's office was provided for. Experimentation was to concentrate on the preparation of instructional units to stress the development of scientific attitudes and facility in the use of the scientific method, particularly.

"With the approval of the Board and the Executive Committee, the plan was presented officially with a formal request to the General Education Board, dated September 5. On October 22, a letter from the Secretary was received saying that the Executive Committee was sorry to inform the Association that the Committee did not find it practicable to act favorably on the request. Further correspondence and conference indicated that the plan as originally proposed would not be likely to receive favorable attention. There is some indication, however, that, should the Association actually get a worth while investigation under way, there might be a chance of a grant from the General Education Board.

"Since December, the matter has stood in this form, to await the official action of the Association in the annual meeting. The Board of Experimentation is desirous of some distinct official action on the proposed experimental program. Is it feasible? Shall we launch a nation-wide experimental or research program? Shall we revise the original plan and make further requests for research funds?"

This report was accepted and the Board continued.

*New Business*

It was regularly moved, seconded, and carried that the Association appropriate $100 for Life Membership to Elliot R. Downing, and a like amount for Life Membership to Otis W. Caldwell. The Secretary was instructed to send a telegram to Dr. Downing and to write to Dr. Caldwell carrying the information to him. The telegram to Dr. Downing was as follows: "Members present at the Dinner Meeting join in hearty greetings and best wishes for speedy recovery. It is a pleasure to tell you that by unanimous vote you and Dr. Caldwell were made regular life members with fees remitted." After the meeting the Secretary addressed the following letter to Dr. Caldwell:

"My dear Dr. Caldwell:

It is a pleasure to write you concerning the action of N. A. R. S. T. that was taken at the meeting in Atlantic City. At the business meeting, it was regularly voted that the Association extend Life Memberships to you and to Dr. Downing. Immediately following the business meeting, this telegram was sent to Dr. Downing (telegram quoted):

You will be interested to know that the meetings were well attended and spirited. In fact, this meeting was one of the best educational meetings in which it has been my privilege to take part. All of us were sorry indeed that you could not be with us."

The dinner meeting adjourned at 10:00 P. M.

The second session of the eighth annual meeting was held on Monday morning, February 25th, at nine o'clock.

There was a report of the Committee on Elementary School Curriculum. This report was made by Florence G. Billig, Chairman. The report included a statement of the work accomplished during the year and plans for the ensuing year. The report of the committee was accepted and the committee continued. Following the advice of the Chairman, Miss Jennie Hall was added to the committee.

There was a report of the Committee on Scientific Attitudes. This report was made by Francis D. Curtis, Chairman. The discussion of the report was carried out as indicated in the printed program. The report was accepted and the committee continued.

The other items of the program were presented as printed.

*Business Meeting*

1. Election of Officers for 1935–1936. The report of the Nominating Committee, consisting of C. L. Thiele, Chairman, H. A. Cunningham, and Bertha M. Parker, was as follows:

*President,* Gerald S. Craig.
*Vice-President,* W. G. Whitman.
*Secretary-Treasurer,* S. Ralph Powers.
*Members of the Executive Committee,* A. W. Hurd and Ira C. Davis.

The report of the committee was accepted and the nominees declared unanimously elected.

2. It was regularly voted by the members present that the sum of $200 be appropriated from the Treasury to meet expenses in connection with the Committee on Scientific Attitudes.

3. The Secretary reported the election of the following members during 1934–35:

P. M. Bail, University of Iowa.

G. P. Deyoe, State Teachers College, Plattsville, Wisconsin.
Myrtle Johnson, San Diego State College, Calif.
M. L. Robertson, Colorado State Teachers College, Greeley, Colorado.
W. W. McSpadden, Austin Public Schools, Austin, Texas.
Bertha Parker, University School, University of Chicago, Chicago, Ill.
Jennie Hall, Minneapolis Public Schools, Minneapolis, Minn.
George W. Haupt, State Teachers College, Westfield, Mass.
R. A. Waldron, State Teachers College, Slippery Rock, Pa.
W. G. Vinal, Western Reserve University.
R. J. Havighurst, General Education Board, New York City.
F. L. Fitzpatrick, Teachers College, Columbia University.

The following individuals were notified of election to membership, but did not accept.

J. E. Kirkpatrick, University of Iowa.
L. S. Ralya, University of Wisconsin.
L. B. Avery, Oakland Public Schools, Oakland, Calif.

The meeting adjourned.

The third session of the eighth annual meeting was held on Tuesday morning, February 26. This was a joint meeting with the American Educational Research Association. The program was presented as printed.

Following the program it was regularly moved, seconded, and carried, that a vote of thanks be extended to Morris Meister, Chairman of the Program Committee, for his guidance in preparing an excellent program.

### *Minutes of the Meeting of the Executive Committee*

Those in attendance were Gerald S. Craig, W. G. Whitman, S. Ralph Powers, and Archer W. Hurd.

It was regularly voted by those present that the Committee on Elementary School Curriculum be allowed expenses not to exceed $25.00.

The following Constitutional Committees were appointed for 1935–36:

1. Program Committee: C. L. Thiele, Chairman, Wilbur L. Beauchamp, Morris Meister.
2. Publications Committee: R. J. Havighurst, Chairman, J. A. Hollinger, Elwood D. Heiss.

The following special committees were appointed.

1. Committee on Constitutional Revision: E. E. Wildman, Chairman, H. A. Cunningham, Benjamin Gruenberg, Hanor A. Webb.
2. Following the recommendation of the Board of Experimentation, a Committee of Five was appointed to prepare a monograph setting forth a possible program of research of this Association during the next few years: Ralph K. Watkins, Chairman, Florence G. Billig, Francis D. Curtis, Ellsworth S. Obourn, Ralph W. Tyler.

Each member of the Committee of Five was designated as Chairman of a smaller committee as follows:

a. Committee on the Education of Teachers: Ralph K. Watkins, Chairman, F. C. Jean, George W. Haupt, H. A. Cunningham.
b. Committee on Elementary School Curriculum: Florence G. Billig, Chairman, W. G. Whitman, Gerald S. Craig, W. W. McSpadden, Bertha M. Parker, M. L. Robertson, Wilbur L. Beauchamp, Ellis Persing, E. Laurence Palmer, Jennie Hall.
c. Committee on Scientific Attitudes: Francis D. Curtis, Chairman, Ralph C. Bedell, Otis W. Caldwell, Palmer O. Johnson, Victor H. Noll, George C. Wood, Morris Meister.
d. Committee on Secondary School Science: Ellsworth S. Obourn, Chairman, Fred G. Anibal, George W. Hunter.
e. Committee on Junior College Science: Ralph W. Tyler, Chairman, F. L. Fitzpatrick, Archer W. Hurd, Palmer O. Johnson.

3. Special committee to draw up a list of active investigators in the field of science education: Victor H. Noll, Chairman, W. L. Beauchamp, R. J. Havighurst.

The resignations of M. E. Herriott, J. L. Cooprider, and C. J. Lapp were accepted.

Respectfully submitted,
S. Ralph Powers,
*Secretary-Treasurer.*

### Treasurer's Report

February, 1935

| | | |
|---|---|---|
| Balance—February, 1934 | $388.27 | |
| Received dues for 1934: | | |
| 58 members at $5.00 (plus .05 collection fee) | 290.05 | |
| Received late dues for 1933: | | |
| 1 member at $5.00 | 5.00 | |
| Total Receipts | | $683.32 |

*Expenditures*

| | |
|---|---|
| To C. M. Pruitt for subscriptions to Science Education for 58 members, plus 1 life member, at $2.00 | $118.00 |
| To A. W. Hurd for expenses in connection with Committee on Criteria | 11.50 |
| To A. W. Hurd for expenses in connection with official work of N. A. R. S. T. | 29.19 |

| | | |
|---|---|---|
| To A. G. Seiler for printing programs for meeting in Cleveland (1934) | 14.50 | |
| To Colonial Printing Company for stationery | 12.50 | |
| To Morris Meister for expenses in connection with program committee | 3.01 | |
| To Postage for 1933 and 1934 | 12.64 | |
| Total Expenditures | | 201.34 |
| Balance | | $481.98 |
| Interest | | 5.16 |
| Balance—February, 1935 | | $487.14 |
| Bank Balance, February 25, 1935 | | $478.48 |
| Cash on hand | | 8.66 |
| | | $487.14 |

## MINUTES OF THE 16TH ANNUAL MEETING OF THE NATIONAL COUNCIL OF SUPERVISORS OF ELEMENTARY SCIENCE

The National Council of Supervisors of Elementary Science met, in their sixteenth Annual Meeting, on February 23, 1935, at the Hotel Chelsea, Atlantic City.

The meeting opened at 9:30 a.m. with the president, W. G. Whitman, presiding. The following program was presented:

*The Rooms, Service, Furnishings and Equipment Used in the Teaching of Elementary Science in the Grades.* H. A. Cunningham, Kent State College, Kent, Ohio.

*Elementary Science with the Classroom Teacher.* Agnes W. Nemir, Supervisor of Science, Glens Falls, N. Y.

*The Development of a Program in Science and Health, Kepueo Elementary School.* Rose Lammel, Colorado State Teachers' College, Greeley, Colorado.

*The Use of Live Animals in Elementary Science Work.* Morris B. Shoemaker, North Arlington, New Jersey; Formerly at the State Museum, Trenton.

*Discussion.*

*Luncheon Meeting—Stag Room.*

Professor C. B. Bazzon, of the University of Pennsylvania, spoke at the luncheon.

Dr. Lois Meier Shoemaker read a message from Albert Einstein. Miss Agnes Nemir read one from Henry Fairfield Osborn and W. W. McSpadden read one from Harlow Shapley.

At the conclusion of the luncheon meeting, Mr. Whitman introduced Miss Bertha M. Parker of the University of Chicago, Chairman of the Editorial Board of the NCSES News Notes, who on the first anniversary of the magazine told of the history of its first year. She presented every one with the fourth number, printed as a birthday surprise.

*Afternoon session, 2:15 o'clock.*

*The Integration of Science and Social Studies in the Elementary Schools.* Rose Wyler, State Normal School, Plattsburg, New York.

*Finding and Using the Natural Resources of the Community.* Marcia A. Everett, Department of Public Instruction, Belvidere, New Jersey.

*Science Activities in the Elementary Schools of Nutley, New Jersey.* Marie Philips, Washington School, Nutley, New Jersey.

*Discussion.*

*Business Meeting.*

The meeting was called to order by the president, W. G. Whitman, State Teachers' College, Salem, Mass.

The minutes of the last meeting were read by the secretary and approved. The following report of the treasurer, having been audited, was approved:

*Treasurer's Report.*

*Receipts*

| | |
|---|---|
| Balance on hand March 1, 1934 | $49.58 |
| Received for dues for 1934–35 | 89.00 |
| Received for subscriptions to Science Education | 28.75 |
| Received for subscriptions to School Science and Mathematics | 4.50 |
| Received for subscriptions to Nature Magazine | 2.00 |
| Received for subscriptions to N. N. N. | 3.50 |
| Received in exchange on checks | .35 |
| Total | $179.68 |

*Expenditures*

| | |
|---|---|
| For stationery, express and bills from Cleveland meeting | $27.54 |
| To Science Education | 28.75 |
| To School Science and Mathematics | 4.50 |
| To Nature Magazine | 2.00 |
| Toward publishing N. N. N. | 50.00 |
| Postage on membership drive | 15.93 |
| Bank drafts | .48 |
| Exchange on checks | .65 |
| Programs for 1935 meeting | 15.00 |
| Tickets—Certificates for membership—directories | 5.50 |
| To Mr. Whitman for stamps, postage, envelopes | 5.19 |
| To Mr. Whitman for other expense | .35 |
| To Mrs. Shoemaker for stencils, paper, postage | 5.45 |
| Typing | 1.25 |
| Total | $162.59 |
| Balance on hand February 23, 1935 | 16.09 |

The president called for a report from the Committee on Public Relations. Edward E. Wildman, Director of Science Education of Philadelphia, as chairman of the Committee, gave a most interesting report of the work being done in Indianapolis. Miss Downhour and Mr. Clute have been working with the relief gardens helping to change vacant lots into gardens. Mr. Wildman also told of some of the work being done in Pennsylvania to preserve old trees. The school children have helped in a campaign against the tussock moth and the elm disease.

A report by the Constitution Committee was made by W. W. McSpadden, in the absence of the Chairman, Miss, Lillian Hethershaw.

W. H. D. Meier moved that Article I be amended to read—This association shall be known as the National Council on Elementary Science. The motion was seconded and carried.

John A. Hollinger moved that Article I, Section 2, b, of the by-laws, be accepted. Motion seconded and carried.

Edward E. Wildman moved that the rest of the constitution be accepted as corrected. Seconded.

A discussion on Article II, Section I, was led by W. H. D. Meier who moved to amend it to read, To promote a science curriculum for the kindergarten and elementary school instead of grades one to six, inclusive. Seconded and carried.

Gerald S. Craig presented, as the report of the nominating committee, the following:

*President,* Bertha M. Parker, College of Education, University of Chicago.

*Vice-President,* Helen Dolman, Michigan State Normal College, Ypsilanti, Michigan.

*Secretary Treasurer,* Harry A. Cunningham, Kent State College, Kent, Ohio.

It was moved and seconded that the secretary be instructed to cast a unanimous ballot for the officers chosen by the nominating committee. Carried.

Miss Florence Billig suggested that some provision be made for selecting an editorial staff for the News Notes. It was moved, seconded, and carried that it be added to the by-laws of the constitution that the selection be made by the executive committee.

It was moved, seconded, and carried that the continuance of the News Notes also be left to the judgment of the executive committee.

It was moved and seconded that the meeting adjourn. Carried. The meeting adjourned.

Monday afternoon, February 25, there was a joint meeting with the Department of Supervisors and Directors of Instruction. The general subject of discussion was "Problems in the Supervision of Elementary School Science." Edward E. Wildman presided. There was a good attendance and a very interesting program.

Helen Dolman,
*Retiring Secretary-Treasurer.*